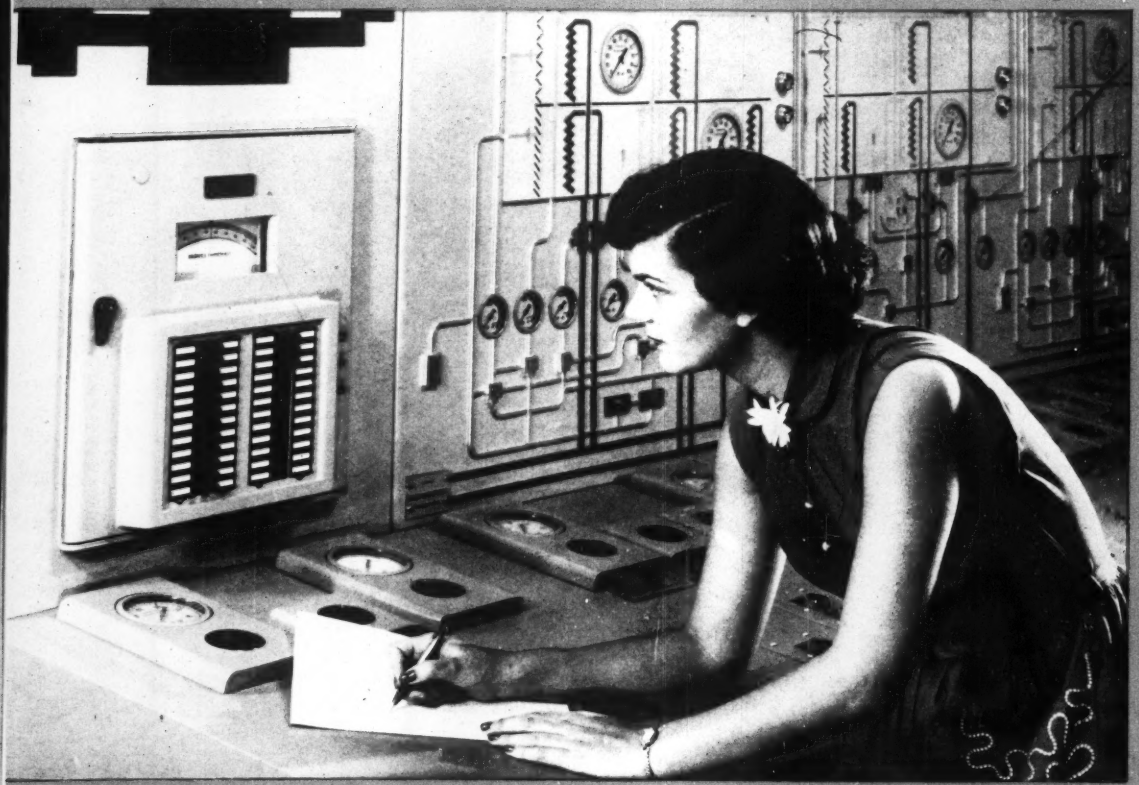
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

JUNE ★ 1952

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 113—Journal Section of The American Society of Heating and Ventilating Engineers



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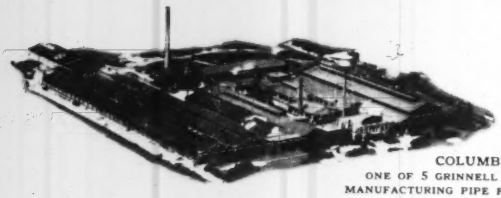


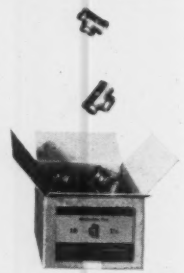
COLUMBIA, PA.
ONE OF 5 GRINNELL PLANTS
MANUFACTURING PIPE FITTINGS

GRINNELL complete-line manufacturer of high quality PIPE FITTINGS

offers you...

- Complete line of high quality malleable iron and cast iron pipe fittings.
- Large stocks of pipe fittings — mass-produced by skilled workers using modern equipment.
- Dependability — the result of finest materials, equipment and methods; assured by rigid production control and triple inspection.
- Coast-to-coast network of branch warehouses and distributors — making available local stocks of Grinnell pipe fittings.

CALL YOUR LOCAL GRINNELL DISTRIBUTOR

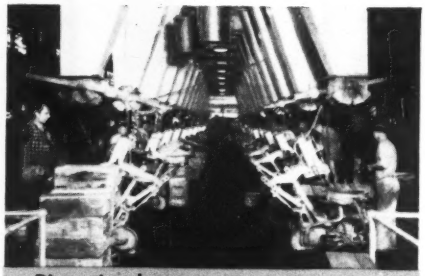


GRINNELL MALLEABLE FITTINGS IN CARTONS

Grinnell malleable iron fittings are available *in cartons* at no extra cost. Cartoned fittings offer you:

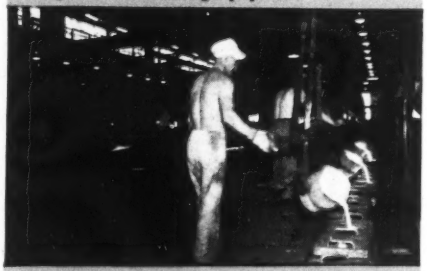
- Faster and cleaner handling.
- Easier storage and shipping.
- Cleaner stocks for resale and use.
- Contents quickly identified by labels.
- Greater accuracy in ordering.

Grinnell malleable fittings are also available in both small bags and large bags.



Dimensional accuracy assured by finest equipment and modern methods of mechanized molding.

Smooth inside finish obtained by the use of the best core sand and the employment of superior core making equipment.



Superior metal, poured into molds on continuous conveyors, gives Grinnell pipe fittings extra strength . . . extra ruggedness.

Accurate chamfer and precision threads, produced by modern tapping machines, provide easy starting and tight joints.

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

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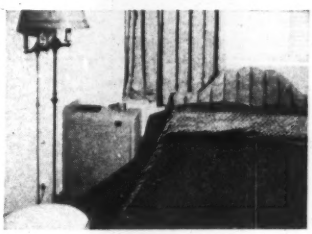
One Individual Room Unit Conditions Two Rooms at Fort Worth's New Fortune Arms

Unique Arrangement Cuts Installation and Operating Costs



One of the 292 Modu-aire units of the Fortune Arms is shown in this modern bedroom. Instead of one complete unit per room, the Modu-aire was recessed through the wall, to the adjacent living room, seen below.

Simple modification of the cabinet face and top adapted usAIRco's individual room unit for use in two rooms. Water chiller provides cold water for Modu-aire coil in summer; boiler provides hot water (through same tubes) in winter.

Over 50% savings were effected at the new Fortune Arms, Fort Worth's largest residential apartments, with the installation of usAIRco's individual room cooling and heating units, Modu-aire.

292 units, ranging in size from 300 to 1500 c.f.m. were used in the 525 rooms and lobbies to give complete year 'round conditioning.

One system of copper tubing (concealed in the walls) carries hot water from the boiler to the Modu-aire coil in the winter; cold water from the water chiller in the summer. Costly and space-consuming ductwork is eliminated.

Savings in operating cost are possible because the Modu-aire unit is controlled by each apartment's occupant. When the number of tenants is reduced at various times of day, only a portion of the system need be in operation.

The elimination of ductwork makes Modu-aire especially desirable for re-modeling hotels, apartments, offices and hospitals . . . as well as for buildings in the process of construction.

See your nearest usAIRco agent or write to Dept. HP 652

UNITED STATES AIR CONDITIONING CORP.
3300 Como Ave. S.E.
Minneapolis 14, Minn.

IT TAKES ONLY ONE
to install pipe

but FIVE
to repair

One of the most convincing demonstrations on the economy of using *durable* material is a repair job where low-first-cost material has failed—and is being replaced.

The original installation had been quickly made by pipe fitters. But the replacement calls for hours of work by as many as five crafts: pipe fitter, mason, plasterer, carpenter, painter. And this is only part of the cost story. The loss in production or utilization during the shut-down may amount to far more than the maintenance charge.

True, you pay a little more to *begin* with for Byers Wrought Iron pipe . . . but you pay a lot less to *end* with. In literally thousands of applications where corrosion costs you more than wrought iron, the use of this material is the soundest kind of economy move.

WHY WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

You will find a lot of helpful information on the control of excessive maintenance through the use of Byers Wrought Iron pipe in our technical bulletin, WROUGHT IRON FOR PIPING SYSTEMS. We will be glad to send you a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco, Export Division: New York, New York.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 24, No. 6

JUNE 1952

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, Cuba, Mexico, Central America, South America, $4.00 per year; other, $6.00. Current copies, U.S. and possessions, 35c each; back copies, 60c each. January 1952 issue, $1.50 per copy. For change of address, notify publisher and your local postoffice of both old and new addresses by the 15th of the preceding month. Member Audit Bureau of Circulations and Associated Business Publications, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc.

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Entered as Second Class Matter May 18, 1929 at the Post office at Chicago, Ill., U.S.A. under the Act of March 3, 1879. Additional entry at Mendota, Ill.

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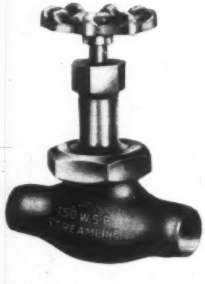
positive shut-off with MUELLER BRASS CO. *Streamline*®

CAST BRONZE VALVES

You always get fast, positive shut-off with Mueller Brass Co. valves because all working parts are accurately machined for perfect alignment with the seating surface in the non-porous, cast-bronze body. Large easy-grip aluminum handwheel is designed to minimize heat transfer to the hand. There are valves for every type of service. They feature heavy duty construction throughout... and are engineered for easy installation. The most frequently required, standard sizes and type of end-fittings are available. Like all Mueller Brass Co. Streamline products, these valves are designed and built to really stand up on the job —to give years of satisfactory service.

GATE VALVES—non-rising stem model permits installation in minimum space.

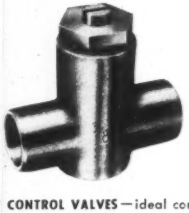


GLOBE VALVES—tough composition disc gives firm seating and resists high temperatures.

COMPRESSION STOPS—ful-flo design eliminates restriction in the line. Available with or without drain.

84

SWING CHECK VALVES—internal swivel pin construction eliminates external packing, packed gland and nut.



FLOW CONTROL VALVES—ideal control valve for radiant panel heating. Compact design requires minimum installation space.

See your jobber for further information or write for catalog S-352 describing our complete line of STREAMLINE wrought copper and cast bronze fittings.

MUELLER BRASS CO. STREAMLINE PRODUCTS

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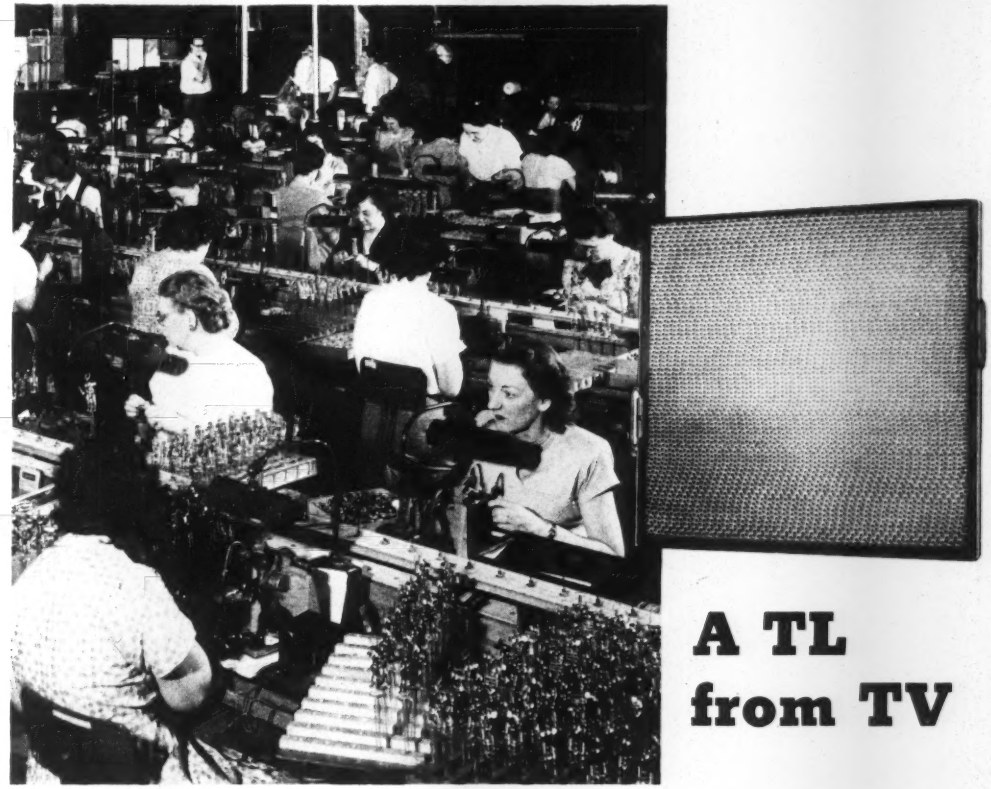


A TL from TV

YES, a large electronics tube manufacturer** handed FAR-AIR* filters a real compliment. He had experienced many rejects in his tube filament coating department, primarily due to heavy dust conditions. Even though automatic air filters were installed, rejects continued to be high. Oil entrainment and air pressure loss from dirty filters also caused difficulties. Maintenance of the filters was frequent and costly, too.

On Farr engineers' recommendation, an installation of Type 44 standard FAR-AIR panel filters was made. Results were astonishing! Electronic tube rejects due to dust dropped over 90% and filter maintenance was practically eliminated by comparison. Based on these results, this manufacturer purchased almost 1,000,000 CFM of FAR-AIR filters!

Under practically any condition, you can improve your air filtration by installing FAR-AIR. The unique herringbone-crimp media design plus many other quality features insures cleaner air, up to 50% less maintenance, lower pressure loss and fewer filters required to handle the same volume of air.

Farr field engineers will be glad to help you properly solve your air cleaning problems. Write today for complete information to Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, California.

**Name furnished on request

FAR-AIR FILTERS

*Trade Mark Reg.

FARR COMPANY *Manufacturing Engineers*

"Better by Farr"

Los Angeles · Chicago · New York

Mf'd under license by Control Equipment Co., Ltd., Montreal, Canada

fedders

145 Pinckney Street, Boston, Mass.

Architect: E. T. Steffian

General Contractor: Industrial Engineering Company

Plumbing and Heating Contractor: C. H. Cronin, Inc.

✳ Hundreds of Fedders Convector-Radiators are contributing to the comfort and appearance of Boston's new River House Apartments.

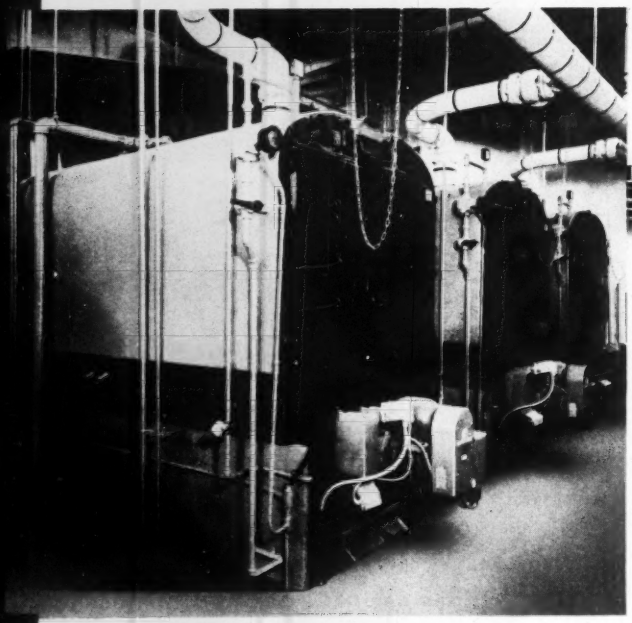
They are in perfect taste with handsome decorative schemes and furniture arrangements.

Architects, interior decorators and contractors are turning to Fedders Convector-Radiators across the nation for uniform floor-to-ceiling temperatures, quick response to modern controls, fuel economy and handsome appearance.

Fedders Convector-Radiators meet standard architectural and roughing-in dimensions . . . they are light in weight . . . compact in size . . . easy to stock and economical to deliver and install.

The ratings of Fedders Convector-Radiators are in conformance with Commercial Standards CS140-47, as developed cooperatively by the trade and the National Bureau of Standards, U. S. Department of Commerce, and the said ratings have been approved by the Convector Rating Committee.

Fedders Type F Convector-Radiator, one of Fedders complete line for residential, commercial and institutional use.



There's plenty of light and air in this new John Sutter School at Canoga Park, Calif. They'll also have plenty of heat, fast heat, *heat when they want it*, from their H. B. Smith Co. Cast Iron Boilers.

Installation of three eighteen-section oil-fired No. 440 Mills Cast Iron Boilers in the new John Sutter School. Note that smaller boiler rooms may be used with H. B. Smith boilers.

Modern Schools are Specifying H. B. SMITH Cast Iron Boilers

School Boards and Superintendents scrutinize very closely the equipment installed in the new schools they are building. First cost is important, but other factors are also given close study. Low maintenance costs; easy facilities for expansion should the school need to be made larger to meet an expanding school population; quick heat to meet the needs of regular school classes and irregular meetings; quick fuel conversion in emergencies — these are a few of the points that are given careful consideration.

Just such a detailed discussion of the facts led to the decision to purchase three No. 440 W-18 Mills Cast Iron Boilers for the John Sutter School illustrated. Other new California schools where Smith-Mills Boilers were chosen after examining competitors' claims are:

Venice Junior High School, Los Angeles —
3 No. 440 S-18 Mills Boilers

Belvedere Junior High School, Los Angeles —
3 No. 440 S-7 Mills Boilers

Precision made, easily and economically installed, Smith-Mills Cast Iron Boilers will deliver faster heat, more economical heat, greater heating efficiency. This is due to their unique design with vertical gray iron water tubes and longer flue travel, which turn more of the fuel burned into heat *used*.

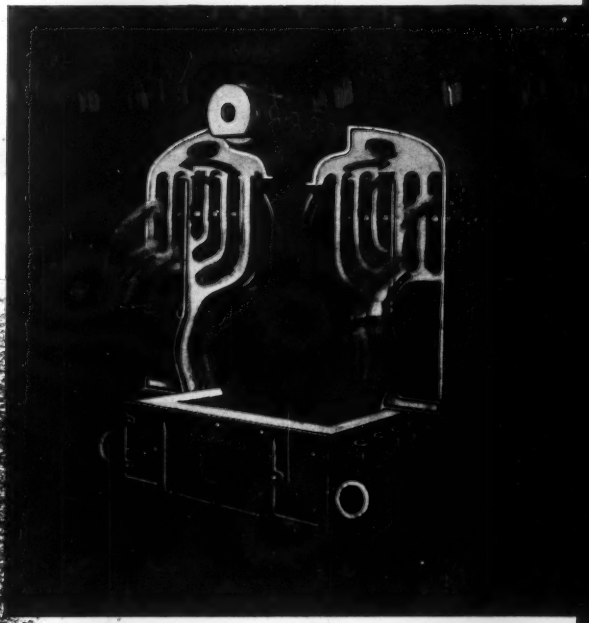
Also of special interest to those school authorities who have the future interests of their communities in mind are the extreme ease with which Smith-Mills Boilers can be increased to supply additional capacity for heat and hot water, and the possibility of quick fuel conversion. As these boilers operate efficiently with *all* fuels, conversion can be made easily from one fuel to another should it be necessary to do so.

H.B. Smith

CAST IRON BOILERS

For Steam or Hot Water Heat

Westfield, Mass. **Established 1853**



Notice how the hot flue gases get *around* the vertical cast iron water tubes: to top of boiler, across to each side, then to front through upper side flue channels, then *down and back* through the lower channels to the smoke outlet.

H.B. Smith Boilers are the first choice

Faster Heat, Greater Heating Efficiency, Ease of Expansion

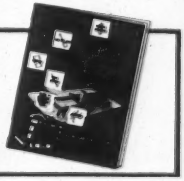
Smith-Mills Cast Iron Boilers turn fuel into heat *faster* because they have greater heating surface and longer flue travel than any other boilers of similar dimensions. Their vertical tube construction makes them virtually self-cleaning and provides for the fast circulation of heated water. Draft loss through the boiler is much less than average: tall chimneys or intricate induced draft mechanisms are not needed.

More heat from less fuel — that's an advantage everyone wants. And that means heating efficiency. The ability of Smith-Mills Boilers to produce steam or hot water faster, to convert more of the fuel into heat for the radiators — with less waste heat up the chimney — has been proved time and again.

The third feature that appeals to school boards and others interested in possible future expansion is the ease with which additional heating capacity can be added to the original installation. New sections, precision machined to fit quickly in place, may be brought in through existing entrances.

For Complete Information to Help You

Write for FREE Booklet "Facts to Consider When Selecting the Boiler for Modern School Heating" which contains authentic case histories.



H. B. SMITH CO., INC. Westfield, Mass.

THE 525 WILLIAM PENN PLACE BUILDING, Pittsburgh, Pa. A John W. Galbreath & Co. enterprise, has 41 stories of ultra modern office space.
Associated Architects
Harrison & Abramovitz . . . New York
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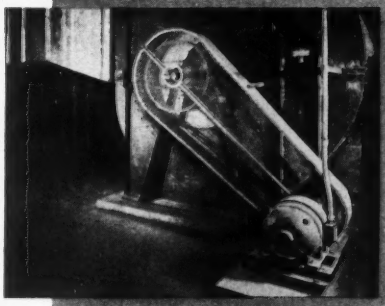
General Contractor
Turner Construction Company
Mechanical Engineers
Meyer, Strong & Jones
Heating, Ventilating & Air Conditioning Contractors
Dravo Corporation

Featuring the most modern equipment, including...

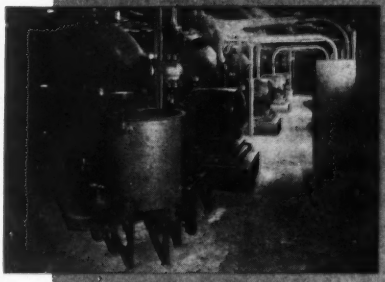
95 ELLIOTT CROCKER-WHEELER MOTORS

A modern "two-zone" air conditioning system assures uniform comfort level in this first completely air conditioned large office building in Pittsburgh, Pa. Throughout the system, Elliott Crocker-Wheeler Protected-Type motors assure minimum maintenance and maximum dependability on vital ventilating fan and pump drives. These versatile motors are the choice for service like this because of their sound design and construction which assure reliable performance and protection against moisture, oil, grit and dust.

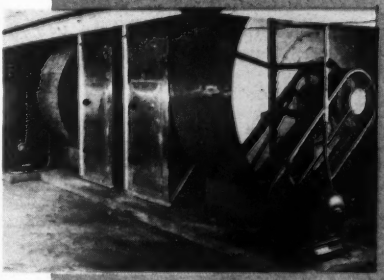
Make it Elliott Crocker-Wheeler motors on your next job. You can't specify better motors for air conditioning systems.



A 15-hp Elliott Crocker-Wheeler motor driving a 39,500 cfm return fan.



Three Elliott Crocker-Wheeler 125-hp motors driving pumps rated at 2275 gpm in the refrigeration system.



Exhaust fans, driven by Elliott Crocker-Wheeler motors, on 15th floor. Foreground: 20,320 cfm fan, 10-hp motor. In rear: 15,000 cfm fan, 7½-hp motor.

ELLIOTT Company

CROCKER-WHEELER DIVISION • AMPERE, N. J.

For large motors: RIDGWAY DIV., RIDGWAY, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J.
SPRINGFIELD, O. • NEWARK, N. J.

W2-15

BRANCH OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES
ELLIOTT APPROVED SERVICE SHOPS COVER THE COUNTRY

Back the Pumps You Use with Nation-Wide Service!

"Follow-Through" like this Makes Friends!

YOUR CUSTOMERS are ours too, once your equipment gets into the field. Allis-Chalmers network of Certified Service Shops assures fast service help wherever the user may be . . . relieves you of one part of your servicing problem.

Engineering Help Too!

Allis-Chalmers engineers can help you pick the type and size pump that best fits the conditions of the job. In addition, they can help check for proper pipe sizes and help work out any design modifications in the pump you may need.

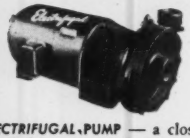
And Allis-Chalmers has the pumps too! There's a type and size pump for practically every job, from fractional units up to the biggest.

Call your nearby Allis-Chalmers district office for complete information, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

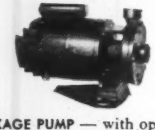
A-3710

Electrifugal is an Allis-Chalmers trademark.

ALLIS-CHALMERS



ELECTRIFUGAL PUMP — a close-coupled pump with both ample maximum space for packing maintenance and exceptional rigidity. From motor end housing to pump casing, frame is one piece of cast iron. Sizes 10 to 1600 gpm; heads to 525 feet.



PACKAGE PUMP — with open or closed impeller. Widely used for air conditioning and refrigeration. Made in several fractional horsepower sizes using NEMA standard motors of well-known make. Capacities to 80 gpm; heads to 100 feet.

PEDESTAL MOUNTED PUMP—For use where flexible coupling or V-belt drive is desired. Essentially the same pump as package pump at left, except that bearing bracket is substituted for motor. A-C also furnishes motor, drive, control. See ratings at left.

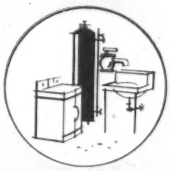
VERTICAL MOUNTED PUMP — Open impeller unit with special cover plate and flange for vertical mounting. Used in air conditioning to save piping cost. Also used as coolant pump for machine tools. Capacities to 80 gpm; heads to 100 feet.

Solved...3 of the biggest...

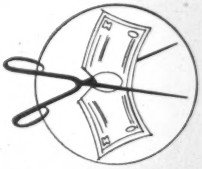
domestic hot water problems with

DETROIT *Vernatherm*® water mixing valves!

1 Reduce water temperature from the heater to a usable temperature at the fixtures.



2 Make available hot water go farther, last longer.



3 Cut water heating costs.

Now, with DETROIT VD-203 and 205 Water Mixing Valves you'll find it easy to cash in on plenty of profitable new business! That's because these remarkable valves, employing the unique and highly sensitive Vernatherm Element, solve three of the biggest and most basic domestic hot water problems facing most homeowners today—and that includes literally hundreds of your prospective customers. What do these valves do? First, by mixing cold water with the hot water from the storage tank, easily installed DETROIT Vernatherm Valves automatically reduce the high storage water temperature from the heater to a usable temperature at the fixtures. In addition, due to this highly efficient and thrifty mixing operation, water is not wasted, as too hot, when a faucet is turned on. The homeowners' available hot water supply, therefore, not only goes farther and lasts longer, but pays off with savings—big savings on water heating costs. So take advantage of this outstanding sales opportunity. See your DETROIT wholesaler today or write direct to the factory for Bulletin No. 246, giving complete information on time proven, long lasting, inexpensive and easy-to-work-with DETROIT Vernatherm Water Mixing Valves.

Stock and Sell these profitable Valves and cash in on what your customers want and need . . .

VD-203 (adjustable)
120°—165° F

VD-205 (non-adjustable)
135°—145° F

* Famous, time-proven Vernatherm, a thermostat employing a special power-creating substance highly sensitive to temperature variations, is the same element used by DETROIT in the manufacture of water mixing valves for automatic washing machines, commercial dishwashing machines, photographic developing machines, diesel, gasoline and jet engine thermostats, aircraft oil cooler controls, and transmission oil cooler controls.

DETROIT
LUBRICATOR COMPANY

5900 TRUMBULL AVE., DETROIT 8, MICHIGAN
REPRESENTATIVES IN PRINCIPAL CITIES
Division of American Radiator & Standard Sanitary Corporation
RAILWAY & ENGINEERING SPECIALTIES, LTD.
Canadian Representatives in Montreal, Toronto, Winnipeg

DETROIT HEATING AND REFRIGERATION CONTROLS • ENGINE SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS

Serving home and industry

AMERICAN STANDARD · AMERICAN BLOWER · ACME CABINETS · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

Honeywell Customized Temperature Control Helps Make Employees More Efficient

Insurance companies' home office personnel do superior work in ideal "climate" provided by specially designed system

Located in Omaha, Nebraska, the big, modern building pictured here houses the home offices of three of the country's largest insurance firms—known as the "Companion Companies." They are United Benefit Life, Mutual of Omaha and United Benefit Fire Insurance Company.

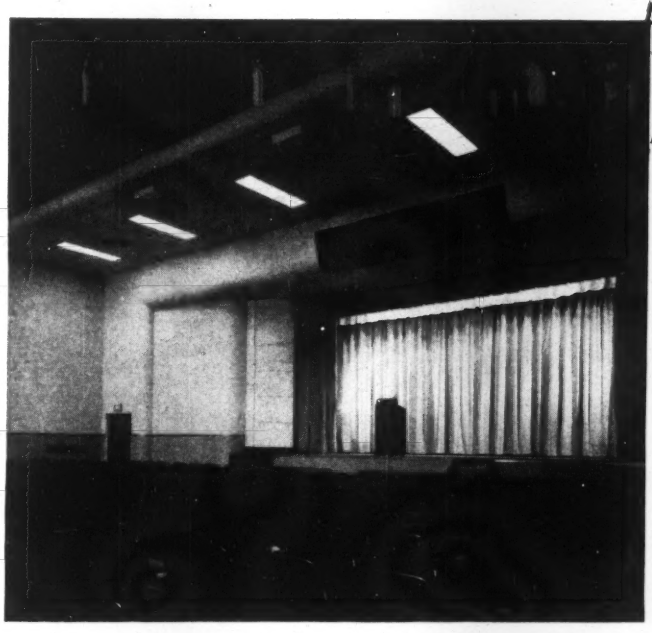
Besides being one of the finest buildings in America, it's one of the most efficient offices in the insurance business.

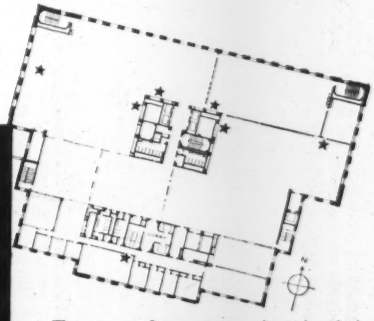
Sound work methods and an advanced personnel policy play important roles in maintaining this efficiency.

And so does the superior kind of *comfort* the building's modern heating and air conditioning plant provides—with help from Honeywell Customized Temperature Control.

Executives of the Companion Companies have found that employees are happier *and more efficient* because of the ideal "climate" that exists throughout the building.

Accurate temperature control is especially important in large office areas. Should the room become uncomfortably warm—or too cold—efficiency would drop. But with Honeywell Customized Temperature Control there's little danger of this.





An important part of the Companion Companies' business planning is built around periodic meetings of top executives with the field force. These get-togethers are held under ideally comfortable conditions in this auditorium that can accommodate 1,300 people.

True comfort can result only if the right number of thermostats are located in the *right places.*

Starred positions on the floor plan above demonstrate how Honeywell Customized Temperature Control makes sure the comfort level will remain constant in the Companion Companies' large office areas.

The four thermostats located centrally — along with the perimeter-located thermostats — are assurance that a large area will be provided with an even, constant temperature.

Building was designed by the architectural firm of Tinsley, Higgins and Lighter, Des Moines, Iowa. Mechanical engineer for heating and air conditioning was Charles S. Leopold, Philadelphia. Honeywell Customized Temperature Control was installed by J. J. Hanighen Co., Omaha.

For Comfortable, Even Temperature in New or Existing Buildings of Any Size, Specify Honeywell Customized Temperature Control

Whether it's an office, store, factory, school, garage — there's a Honeywell Customized Temperature Control System to meet your clients' heating and ventilating problems.

Once equipped with this system, they'll have an ideal "climate" — and they'll save fuel besides.

For full facts on this special system, call your local Honeywell office. There are 91 across the nation. Or mail the coupon today.

"The system itself is mighty efficient, too," says Charles L. Gier, United Benefit Life's superintendent of maintenance.

"Being an engineer, I like the trouble-free way our Honeywell Customized Temperature Control system *operates.*"

Minneapolis-Honeywell Regulator Co.
Dept. HA-6-126, Minneapolis 8, Minnesota

Gentlemen: I'm interested in learning more about Honeywell Customized Temperature Control.

Name .....

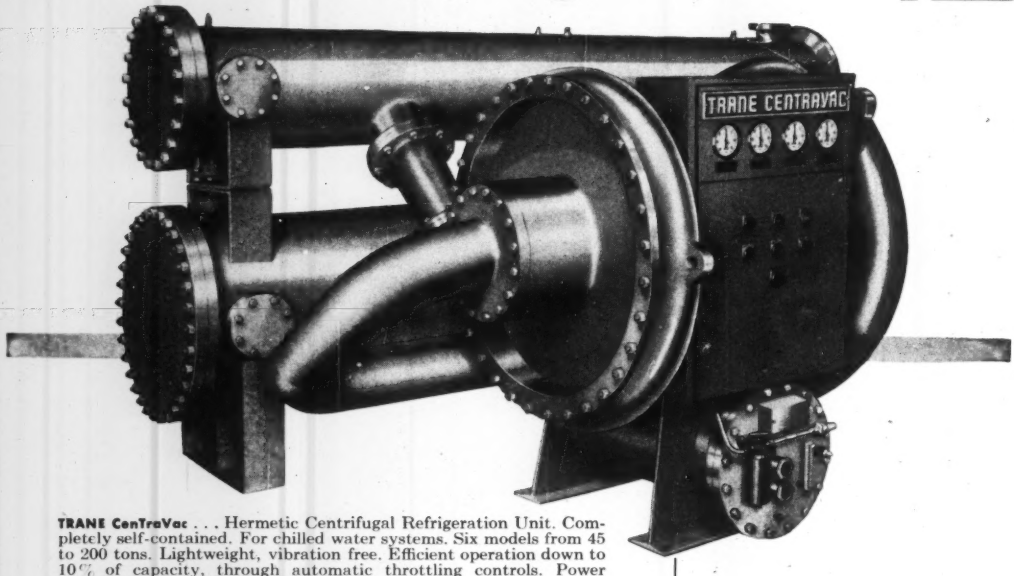
Firm Name .....

Address .....

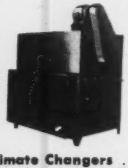
City ..... *Zone* ..... *State* .....

MINNEAPOLIS
Honeywell
First in Controls

These TRANE products fit air conditioning results you



TRANE CenTraVac . . . Hermetic Centrifugal Refrigeration Unit. Completely self-contained. For chilled water systems. Six models from 45 to 200 tons. Lightweight, vibration free. Efficient operation down to 10% of capacity, through automatic throttling controls. Power consumption very closely proportionate to-load through entire range.



TRANE Climate Changers . . . basic air conditioning units, built for widest range of requirements. Combine coils, fans, humidifiers, filters, dampers. 450 to 22,000 cfm.

TRANE Evaporative Condenser . . . for condensing refrigerant in the air conditioning system where water is scarce or expensive. Cuts water consumption as much as 90%.

TRANE Multi-Zone Climate Changer . . . A single air conditioner that provides heat or cooling or both simultaneously to as many as 8 different zones.

MANUFACTURING ENGINEERS OF HEATING, VENTILATING

TO MATCH THE JOB...

together to give you the want!

What air conditioning results do you want? Have you a simple cooling problem—or a complex one? Is it small or large? Does the job require only cooling or does it involve the related problems of heating and ventilating?

Regardless of the nature or scope of your next air conditioning project, the *complete* line of TRANE matched air conditioning products contains exactly the equipment needed to do a superlative job.

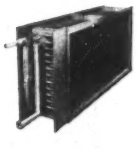
Consider these advantages:

1. UNDIVIDED RESPONSIBILITY The completeness of the TRANE line makes it possible to get the undivided responsibility of one manufacturer.

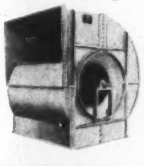
2. ONE SOURCE OF SUPPLY You save time by dealing with one competent specialist — the TRANE sales engineer —instead of many.

3. ONE SET OF CATALOGS From one handy and complete set of catalogs you can select all the equipment you need.

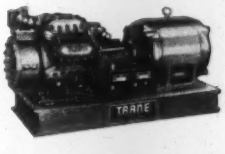
4. COMPLETE FLEXIBILITY There's a wide range of sizes and models. So flexible is the line, you can, for example, create 10 different 50-ton air conditioning systems.



TRANE Cooling Coils . . . Efficient fin-and-tube extended surface. For use with chilled water, well water, or direct expansion refrigerants.



TRANE Centrifugal Fans . . . Class I and II construction with backwardly inclined or forward-curved wheel design. Ruggedly built. Quiet operation.



TRANE Reciprocating Compressor . . . Capacities up to 50 tons. New, automatic cylinder unloading saves power through multi-step reduction.

TRANE Self-Contained Units . . . all-in-one package. 3- to 20-ton capacity. Heating coil optional. 15- and 20-ton available with built-in evaporative condenser.

TRANE UniTrane and Custom-Air Systems . . . Multi-room air conditioning. Individual room control of heating, cooling, humidifying.

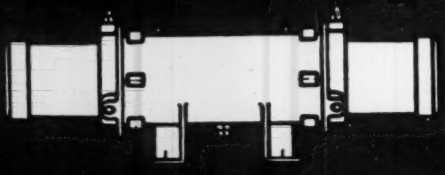
Why not join the many architects, engineers and contractors who specify and install TRANE Equipment? Call or see your nearest TRANE sales engineer when you plan your next air conditioning project.

AND AIR CONDITIONING EQUIPMENT

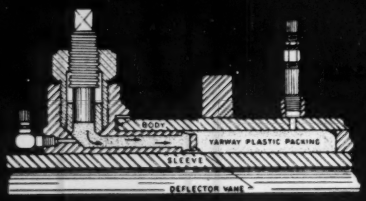
TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd. . . Toronto
Offices in 80 U.S. and 14 Canadian Cities

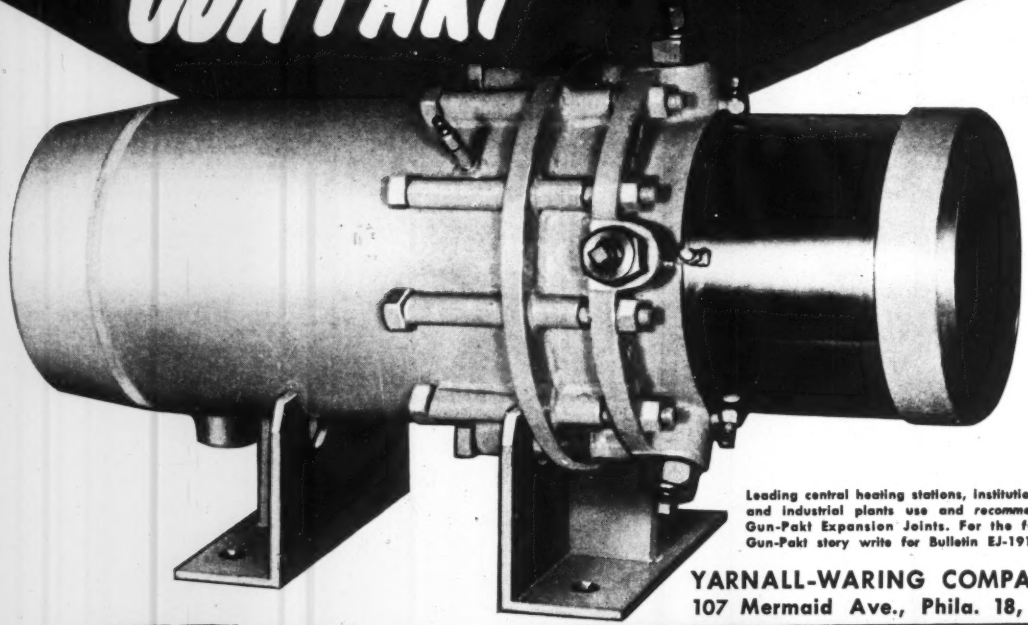
YOU NEED FEWER JOINTS



AND LESS MAINTENANCE



W GUN-PAKT ints



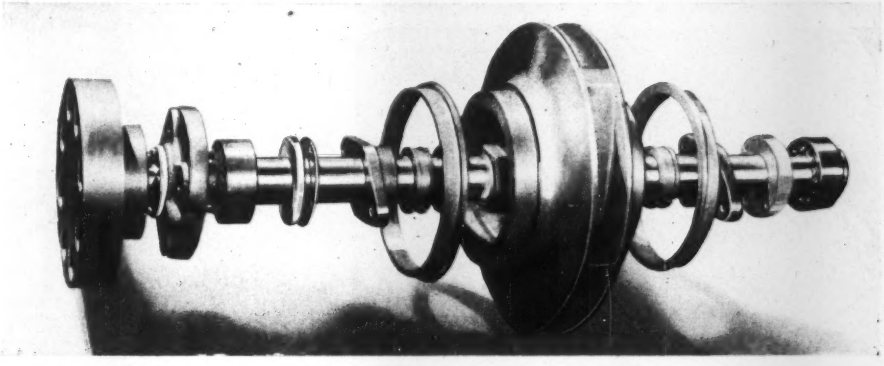
Leading central heating stations, institutions and industrial plants use and *recommend* Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

"Buffalo" *Tips on Better Pumping*

THE IMPORTANCE OF GOOD IMPELLER CONSTRUCTION



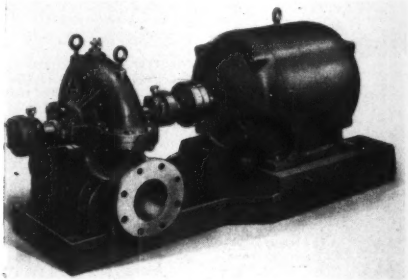
The impeller, being the part of the pump that moves the liquid, is naturally subjected to the most punishment in the form of shock, abrasion or corrosion, depending on the hydraulic conditions.

Above is the rotor and shaft assembly of a "Buffalo" Type "SL" Double Suction Pump for clear water service. The shaft is oversize. It is machined of high grade steel, bronze covered, or solid monel metal or other alloy.

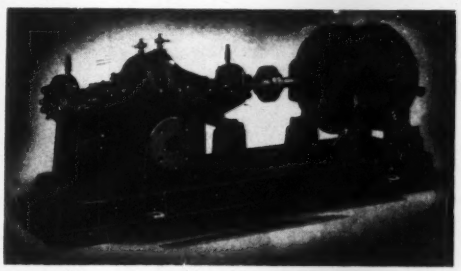
The bronze impeller is mounted on an enlargement of diameter at the center of the shaft and secured by feather key and lock nuts. The impeller is hydraulically balanced — always receiving water from opposite sides in equal volume and pressure. The entire assembly is also in perfect dynamic balance for vibrationless performance. Such an impeller is not only highly efficient in its liquid handling, it is built to stand continual service.

Another example of heavy-duty, high-efficiency construction is the popular "RR" Pump shown at left. Available in 2 and 4 stage models for pressures up to 500 lbs., it is widely used for boiler feed and other clear water service.

FOR ALL ENGINEERING DATA on "Buffalo" clear water pumps, write today for Bulletins 980 and 955-P.



"Buffalo" Type "SL" Pump



"Buffalo" Type "RR" Pump

"Buffalo"

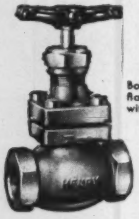
BUFFALO PUMPS INC.

171 MORTIMER STREET BUFFALO, NEW YORK

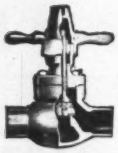
Canada Pumps Ltd., Kitchener, Ont. *Sales Representatives in All Principal Cities*

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

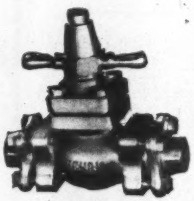
PACKLESS VALVE
With balanced-action



AMMONIA VALVE
Bolted Bonnet — screw or flanged connections. Also with screwed bonnet, sizes 1" and under



WING CAP VALVE
Non-ferrous



WING CAP VALVE
Semi-steel—with companion flanges and adapters

HENRY VALVE CO.
CONTROLLING FLOW
SINCE 1914

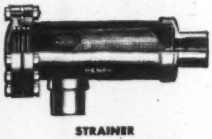
you pay—

no premium for..

the extra advantages found in

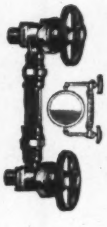
Henry products

or for the extra satisfaction that follows their use

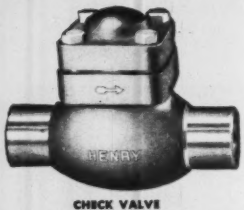


STRAINER
Angle type with patented distortion-proof flange

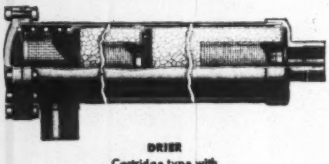
Y-STRAINER
Brass plated. Welded steel construction with forged brass connections. Size ⅜" O. D. S. through 4⅛" O. D. S.



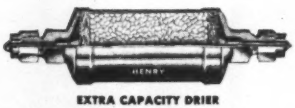
BALANCED-ACTION PACKLESS LIQUID LEVEL GAUGES
Valves are backseating—diaphragms may be inspected or replaced without loss of liquid. Conforms with all safety code requirements.



CHECK VALVE
Piston Type For Freon. Sizes ⅜" through 4⅛" O.D.S.



DRIER
Cartridge type with dispersion tube



EXTRA CAPACITY DRIER
2 cubic inches more than established practice. Forged brass end caps.

. . . Write for these catalogs

No. 100 Packless and packed valves, strainers, driers, ammonia valves, check valves, relief valves, three-way valves, scale traps, liquid gauge sets, flange unions, nut unions and accessories for air conditioning and refrigeration and industrial uses.

No. 70 Drop forged and cold rolled steel fittings.

DIAPHRAGM RELIEF VALVE
Large capacity—fast positive relief and reseating action. Very small differential between opening and closing pressures.

STRAIGHT-THROUGH RELIEF VALVE
Large capacity—All Brass Construction. Sizes ¼" M.P.T. through 1" F.P.T.

Stocked and Sold by Leading Jobbers

VALVES • DRIERS • STRAINERS • CONTROL DEVICES and ACCESSORIES FOR REFRIGERATION and AIR CONDITIONING and INDUSTRIAL APPLICATIONS

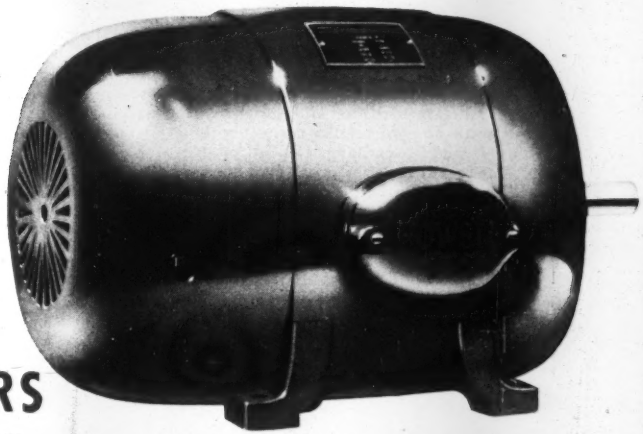
HENRY VALVE COMPANY

MELROSE PARK, ILLINOIS—Chicago Suburb • Cable: HEVALCO, MELROSE PARK, ILLINOIS

Air Conditioning

Leading Manufacturers Rely on Howell Motors. Whether you make complete central-systems or room air conditioners, you can depend on Howell to supply motors that have the same extra quality you build into your own products. Air conditioning and refrigeration contractors, too, can lower the cost and frequency of service calls by installing precision-built Howell Motors. Call your Howell representative for quick, expert assistance.

Howell concentrates on industrial-type motors, 1/6 to 250 H.P., standard or special types, for civilian or military needs. Manufacturers in every industry specify them, depend on them.



HOWELL Red Band MOTORS

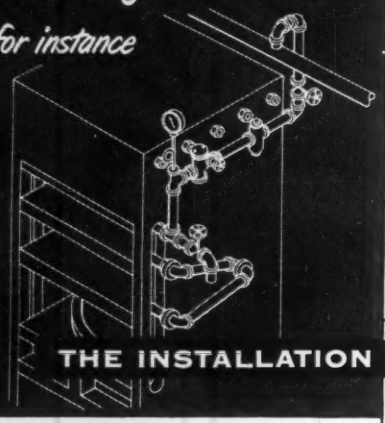
HOWELL MOTORS

Precision-built Industrial Motors Since 1915

HOWELL ELECTRIC MOTORS CO., HOWELL, MICHIGAN

Will Your Pressure Regulators Last 25 Years?

...on Molding Press Service for instance



THE INSTALLATION

Crane Brass Pressure Regulators on steam lines to rubber molding presses; Dryden Rubber Division, Sheller Mfg. Corp., Chicago. 225 units in service.

VALVE SERVICE RATINGS

FEATURES:	Equally good on steam or air
SUITABILITY:	Steady outlet pressure - no drift
MAINTENANCE COST:	Routine servicing only
SERVICE LIFE:	Many installed more than 25 years — Still O.K.
OPERATING RESULTS:	Fully automatic steam control at lowest cost
PRICE:	Good Buy - has no equal
AVAILABILITY:	Stock item in Crane Line

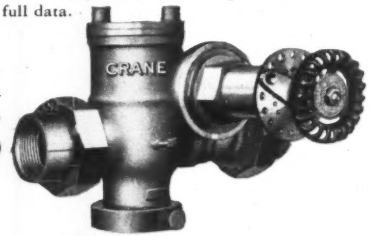
THE HISTORY

Steam generated at 130 psi is reduced through individual regulators on molding presses. Pressure used at machines is 60 to 100 psi depending on work. Features of regulator service needed most are: (1) non-fluctuating outlet pressure automatically maintained within close regulation; (2) easy adjustment by press operator to specified pressure for given work.

More than 25 years ago the plant standardized on Crane Regulators, a total of 225 being in use today. Many are the original installations, still delivering desired outlet pressure. Records for all regulators, regardless of age, show no maintenance cost other than prescribed simple routine servicing. On old models of the Crane 960 regulator, after prolonged service, this includes occasional regrinding of seats.

THE VALVE

Crane No. 960 Brass Pressure Regulators reduce steam or air pressures up to 250 psi, to within 80% of inlet pressure. Factory pre-set to operate within any of 4 ranges from 1 to 200 psi, with easily selected service pressure within set range. Precision made; fully automatic; highly dependable, even under reasonable fluctuation of inlet pressure. All wearing parts renewable. See your Crane Catalog or Crane Representative for full data.



The Complete Crane Line Meets All Valve Needs. That's Why—

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

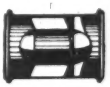
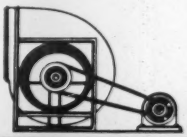
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

"Buffalo"

Tips on Getting the Best Service from your **Fans**

MAKING THE RIGHT SELECTION

AXIAL FLOW?  or CENTRIFUGAL? 

Centrifugal fans like this "Buffalo" Limit-Load model are generally the first choice for large ventilation, exhaust and air conditioning systems. Their efficiency is high even when installation is at a curve in the duct. Medium speed fans, they are ideal for handling large volumes of air quietly at medium pressures. "Buffalo" Limit-Load Fans have the additional advantage of being non-overloading, regardless of the system pressure. For further factors in the selection of a centrifugal fan, write for Bulletin 3737.

"Buffalo" BUILDS BOTH TYPES

Axial Flows on the other hand, move air by the propeller principle, straight through the fan housing. These fans will thus be most efficient mounted in straight runs of duct. They are ideal for light-duty ventilation and air conditioning service at pressures to around 2". Axial Flows are higher velocity fans than centrifugals, are lighter weight and more compact than centrifugal fans, therefore lower cost for duct-mounting on ceilings, walls, etc. However, the performance curve is often the last analysis in your choice of fan for each job. "Buffalo" Bulletin 3533-C contains a comparison performance chart of both "Buffalo" Limit-Load Fans and Axial Flows. A copy will be mailed to you on request.

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

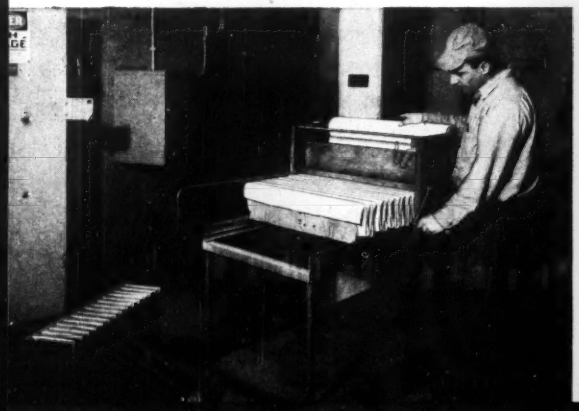
171 MORTIMER ST. BUFFALO, NEW YORK

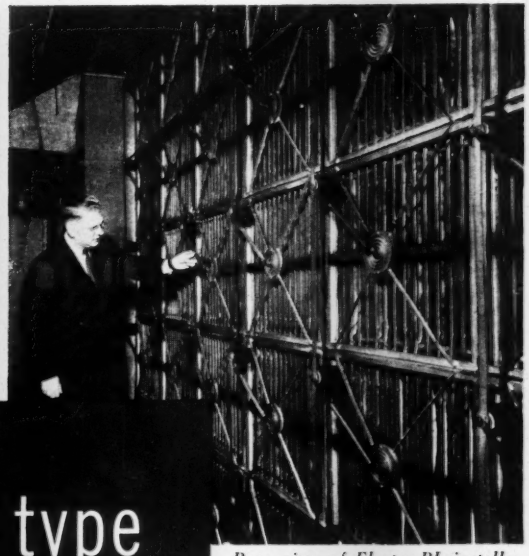
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING | AIR CLEANING | AIR TEMPERING | INDUCED DRAFT | EXHAUSTING
FORCED DRAFT | COOLING | HEATING | PRESSURE BLOWING

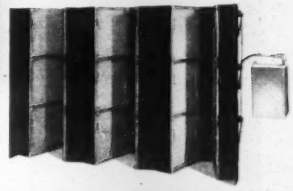
An Electro-PL installation of 25,000 cfm cleaning the air for a large Midwest library to protect rare books and manuscripts. The operator is removing a collector element for servicing.



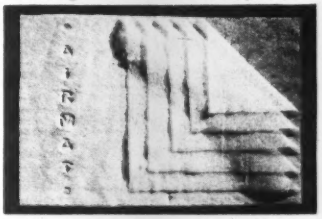


...the only dry type electronic air filter

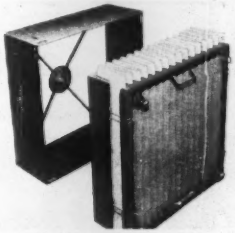
Rear view of Electro-PL installation showing electrical connections to individual units.



The Electro-PL may be installed in V-arrangement to conserve space.



6 ply Airmat filtering material composed of porous tissue-thin sheets of cellulose fibers.



Electro-PL Unit consists of frame and collector element.

ELECTRO-PL gives twice the filtering efficiency of ordinary dry filters . . . at low initial cost.

The Electro-PL is an exclusive development of AAF engineering research.

The many advantages and low initial cost of the Electro-PL account for its broad applications in both industry and commerce. Engineered for simple, economical maintenance, it requires no water and sewer connections . . . needs no oil to retain precipitated dust. The Electro-PL is easy to install, safe to operate, and becomes essentially a new filter each time the Airmat media is renewed. Another important "safety" plus is that the Electro-PL maintains efficient air filtration even when there are power failures.

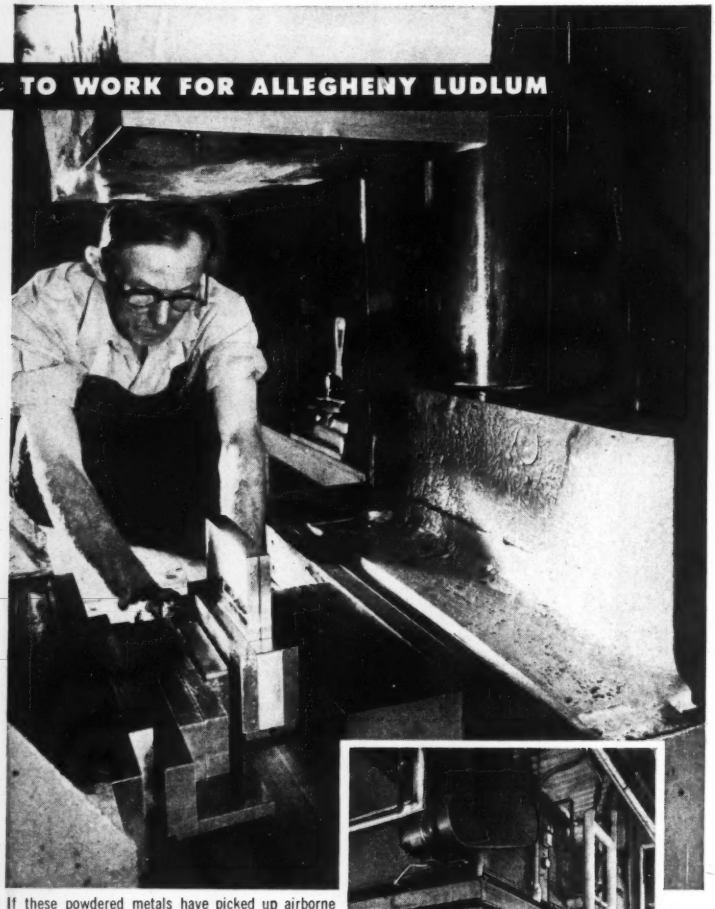
For information on Electro-PL call your local AAF representative or write direct to us for our Engineering Bulletin No. 257.

American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Kentucky

American Air Filter of Canada, Ltd., Montreal, P. Q. • Pacific Division Office, San Francisco, Cal.

PUTTING *Air* TO WORK FOR ALLEGHENY LUDLUM



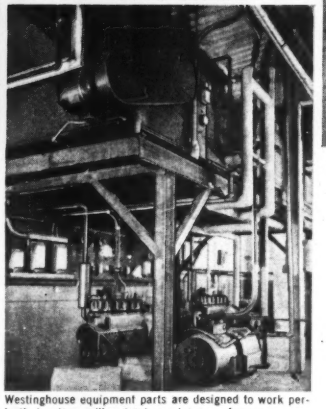
THIS MOLDING OF METALS NEEDS PERFECT AIR

If these powdered metals have picked up airborne impurities, they will not bond properly no matter how much pressure is applied.

Molding powdered tungsten and cobalt under pressure to form carbide tool bit blanks is tricky. Tungsten, high on the list of critical metals, is extremely vulnerable to oxidation in moist air. Airborne contaminants cause flaws, too, which would be reflected in the quality of the finished tools and bits and by irregularities in their working life.

Carefully controlled, filtered air is a basic requirement, so Westinghouse* helped Allegheny Ludlum's Carmet Division *put air to work* regulating the humidity to prevent oxidation and raise quality. The air is kept free of impurities by PRECIPITRON®, the electronic air cleaner that is many times more efficient than mechanical filters.

What's your air control problem? If it involves air conditioning, air cleaning or air handling, there's a complete line of reliable, industry-proven Westinghouse equipment to fill your needs. Call the Westinghouse Air Conditioning Distributor listed in the Yellow Pages, or write Westinghouse Electric Corp., Air Conditioning Division, Hyde Park, Boston 36, Mass.



Westinghouse equipment parts are designed to work perfectly together, will install in a minimum of space.

Atmospheric conditions in the quality control lab must be constant, matching those in the manufacturing areas.

*Installation by Mechanical Heat & Cold, Inc., Detroit, Michigan.

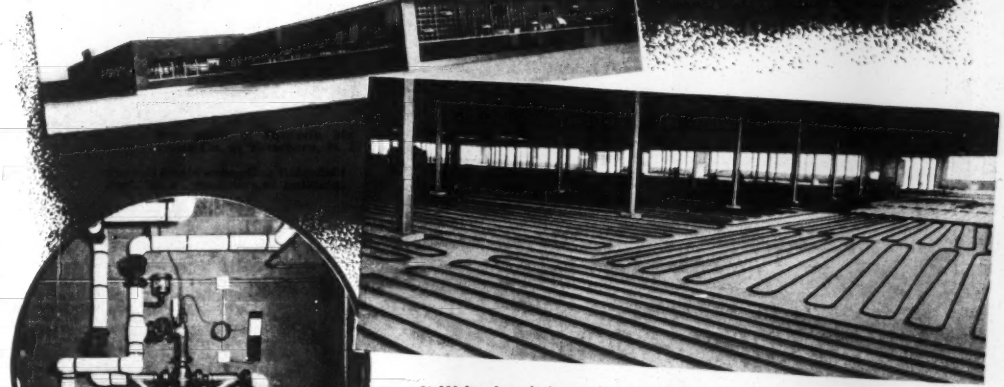
YOU CAN BE SURE...IF IT'S

Westinghouse

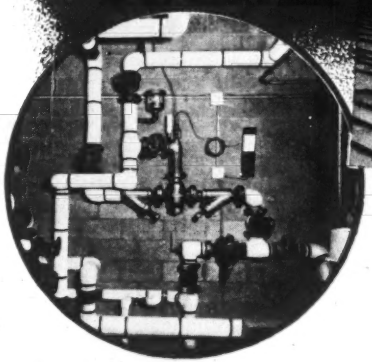
J-80251

Sarcotherm

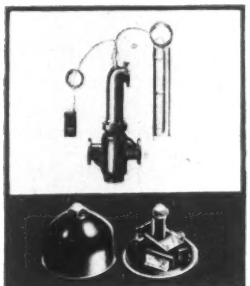
chosen for POTDEVIN MACHINE COMPANY'S LARGE PLANT



86,000 ft. of steel pipe are arranged in serpentine coils for the radiant heating system. Heating Contractor, Frank Lawton, Paterson, N. J



One of the 5 Sarcotherm Control valves, protected by strainers. A Sarcotherm Air Eliminator will be noted at the right.



The heart of the Sarcotherm control system is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.

The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

This latest addition to the industrial plants at Teterboro terminal covers an area of 102 thousand square feet.

The single story building is radiant heated by floor coils requiring 86,000 feet of pipe.

The system is divided into five zones, each controlled by a 3″ Sarcotherm Control Valve, type STA-1D, with Thermoray heat-loss thermostat for each zone.

Sarcotherm also furnished Sarcoflow balancing fittings, access boxes, strainers and other accessories.

This is the largest single story industrial building in the East, radiant heated by floor coils.

We are proud that

Sarcotherm Control

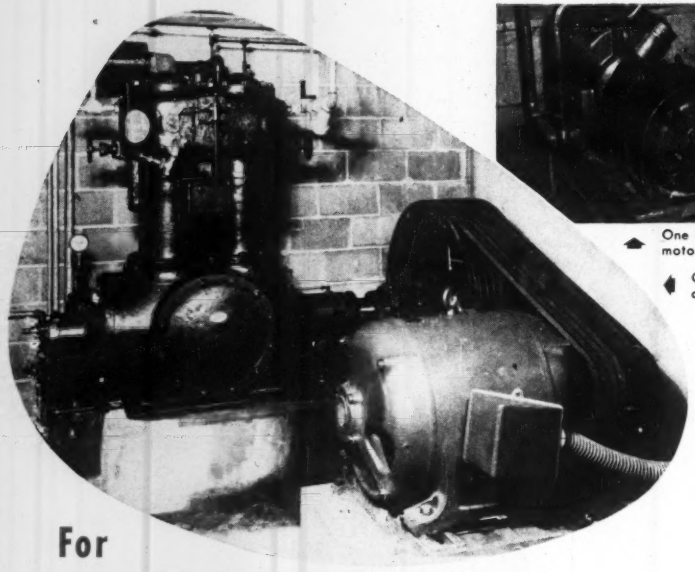
was selected for this outstanding job. Individually engineered Sarcotherm Control systems are available also for conventional forced Hot Water or Steam Heating Systems. Our Engineering Department will be glad to assist on your next job.

24

Sarcotherm CONTROLS, INC.

EMPIRE STATE BUILDING · NEW YORK 1, N. Y.

A SARCO PRODUCT



One 10 horsepower and a 25 horsepower Century motor furnish power to air condition an office.

Century 75 horsepower Type SCH motor driving a compressor in a skating rink.

Unusually Quiet Starting and Running Characteristics

For REFRIGERATION COMPRESSORS

You Need the High Starting Torque of . . . . . Century

Century Service Is Near Any Century Motor Driven Equipment. Prompt Service is offered by CENTURY'S National Network of more than 200 Authorized Service Stations, supervised by 28 Century Sales offices.

1. *Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.*
2. *CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.*
3. *Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.*

Type SCH Motors

Century Type SCH, Squirrel Cage polyphase alternating current High Torque motors are ideal for refrigeration compressor applications. They bring compressors up to speed smoothly and easily under full load.

Century Type SCH motors have the high starting torque characteristics required for Refrigeration Compressors. The low starting current is desirable for automatic across the line starting.

In addition, Century builds a complete line of electric motors in a wide range of types, in sizes from 1/8 to 400 horsepower. Specify Century motors for all your electric power requirements.

Century C MOTORS

CENTURY ELECTRIC COMPANY • 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

702

BRONZE "QUICK-FLO" QUICK OPERATING LEVER GATE VALVE

BRONZE QUICK OPERATING LEVER GATE VALVES

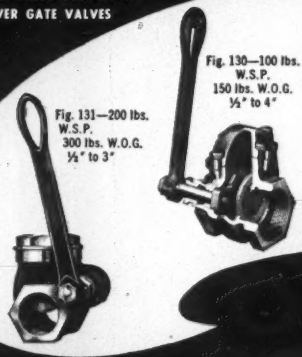


Fig. 131—200 lbs. W.S.P. 300 lbs. W.O.G. ½" to 3"

Fig. 130—100 lbs. W.S.P. 150 lbs. W.O.G. ½" to 4"

Fig. 736—125 lbs. W.S.P., 200 lbs. W.O.G. ¾ to 3". Also listed as standard by Underwriters' Laboratories. Approved by Factory Mutual Laboratories for use on devices handling gasoline, naphtha, fuel oil, etc. at a maximum working pressure of 50 lbs. Be sure to specify service.

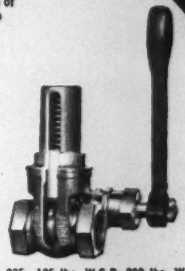


Fig. 835—125 lbs. W.S.P. 200 lbs. W.O.G. ¾" to 3". Approved by Factory Mutual Laboratories for the handling of gasoline, lacquer thinners, and similar liquids at a maximum working pressure of 50 lbs. Be sure to specify service.

Fig. 231—All Iron 125 lbs. W.S.P., 175 lbs. W.O.G.—1 to 4" inc. 100 lbs. W.S.P., 150 lbs. W.O.G.—5 - 6"

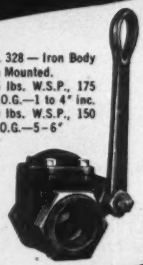


Fig. 328 — Iron Body Bronze Mounted. 125 lbs. W.S.P., 175 lbs. W.O.G.—1 to 4" inc. 100 lbs. W.S.P., 150 lbs. W.O.G.—5 - 6"

BRONZE "QUICK-FLO" SELF CLOSING LEVER GATE VALVE

IRON BODY QUICK OPERATING LEVER GATE VALVES

Fig. 132—Iron Body Bronze Mounted. 175 lbs. W.S.P., 250 lbs. W.O.G.—2 to 4" inc. 150 lbs. W.S.P., 200 lbs. W.O.G. 5 - 6"

Which of these 7 QUICK OPERATING VALVES fits your needs

D. T. Williams offers you a complete line—from general purpose types to those that are self-closing, Underwriters' Laboratories listed or Factory Mutual approved. All are faultlessly engineered, quick and dependable in operation!

See your nearest jobber or write for literature.

D.T. Williams VALVES — GUARDIANS OF THE PIPELINES

THE D. T. WILLIAMS VALVE CO.
Founded 1904
Division of *The Schaible Company*
SUMMER STREET • CINCINNATI 4, OHIO

FOR MEASUREMENTS FROM −100 F TO −300 F, G.E.'S TYPE HP-13 ON-OFF CONTROLLER GIVES STABILITY, ACCURACY, AND CONTROL SENSITIVITY

G-E Resistance-thermometers have High Accuracy; Can Be Calibrated within 1/2 of 1% Full Scale

Temperatures from −100 F to −300 F can now be accurately indicated and controlled with General Electric's new line of resistance-thermometers. If you have an operation which demands close, accurate control, then there is a G-E resistance-thermometer tailored to your needs. Under certain conditions accurate indication is within ½ of 1 per cent full scale.

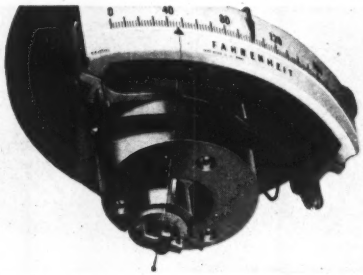
CONTROL SENSITIVITY is built into G-E resistance-thermometers. A pointer motion not exceeding 0.1 per cent full scale length causes on-off operation in the presence of variations in voltage, ambient temperature, and frequency.

SPECIAL FEATURES include a mercury switch, rated 35 amperes for 120 volts a-c or 25 amperes for 240 volts a-c, available as an optional accessory for applications where heating loads exceed 10 amperes. When larger electrical capacity than that afforded by either control relay or mercury switch is required, a magnetic contactor can be supplied.

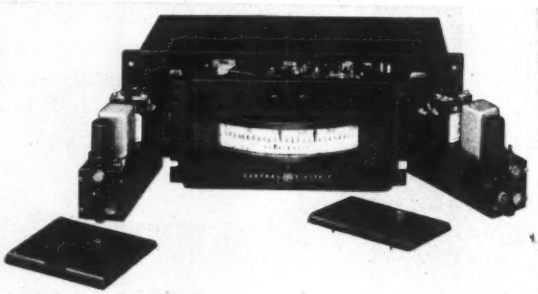
WIDESPREAD USE of G-E resistance-thermometers is a testimonial to their value. These close-control instruments can be used in refrigeration and food-processing industries, air-conditioning, medical and research laboratories, and in many applications where close control is a necessity.

MORE INFORMATION is available. Contact your nearest G-E representative, or write Section 602-230 for Bulletin GEC-835. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC



BASIC ELEMENT of G-E resistance-thermometers is crossed-coil moving element and 3¼-pound alnico V magnet; designed to stand abuse.

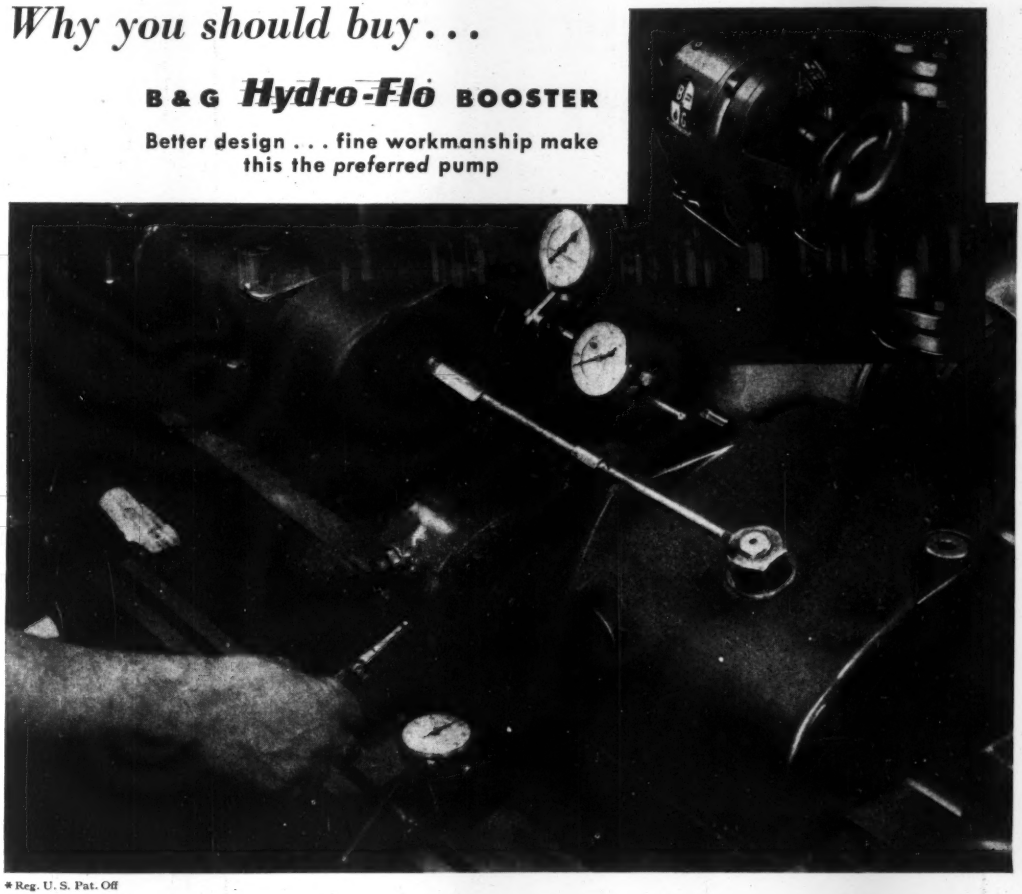


TYPE HP-14 three-position resistance-thermometer with two-plug-in control units; shown with covers removed for easier maintenance.

Why you should buy . . .

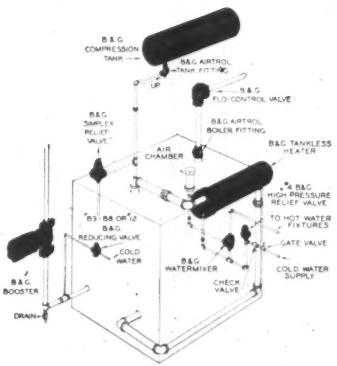
B & G *Hydro-Flo* BOOSTER

Better design . . . fine workmanship make this the *preferred* pump



* Reg. U. S. Pat. Off

Precise to .0005 of an inch



B & G *Hydro-Flo* Products offer everything you need for forced hot water heating systems and domestic water heating. Look for the B & G label—symbol of quality.

Here you see one of the reasons *why more B & G Boosters are sold than all other circulators combined!*

You are looking at the final finishing operation in producing Booster pump shafts. All shaft dimensions are maintained within .0005 inch limits with these extremely accurate grinders. Note the micro-gauges. One indicates the surface flatness of the thrust collar, one the diameter of the shaft and the third is used to position the work in the machine. When finished, Booster pump shafts are mirror smooth and exactly uniform!

All Booster parts are made with similar attention to the quality of workmanship. That's why B & G Boosters are setting records for long, *quiet* and dependable performance. Thousands have been in operation for many years *without need for service of any kind!*

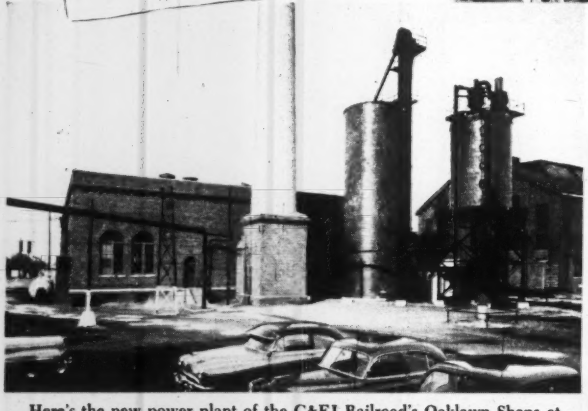
BELL & GOSSETT
COMPANY
Dept. CN-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

"BURNING COAL THE MODERN WAY CUT OUR POWER COSTS $51,000 A YEAR!"

"Up-to-date coal installation cut fuel consumption 20.3%... labor force 47%!"

says Mr. George E. Bennett, Supt. Motive Power, Chicago & Eastern Illinois Railroad.

"We recently modernized the power plant at our Oaklawn Shops in Danville, Illinois. The savings we've realized in labor and fuel proved to us you can't beat *bituminous* coal burned with modern equipment."



Here's the new power plant of the C&EI Railroad's Oaklawn Shops at Danville, Illinois. By burning coal the modern way this plant saves a total of $51,180 a year—*will pay for itself in less than seven years.*

This is a view of the firing aisle showing the spreader stokers which are fed by a weigh larry. Three new boilers now do the work that formerly required seven. Man-days per week required to operate the plant have been reduced from 112 to 59!

● Low price—dependable supply—safe storage—coal gives you all these no matter how you burn it.

But you can get much more!

Get more steam for every dollar—burn coal in a *modern* combustion installation. Cut your labor costs—install automatic coal and ash handling equipment. If you call in a consulting engineer—he can show you how coal can do a better job for you with equipment designed to meet your *specific* needs.

Of all the fuels, coal alone has virtually inexhaustible reserves. And to supply this coal, America has the world's most productive and efficient coal industry. That's why you can count on coal for dependable supply, relatively more stable prices—now—and in the future, too!

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

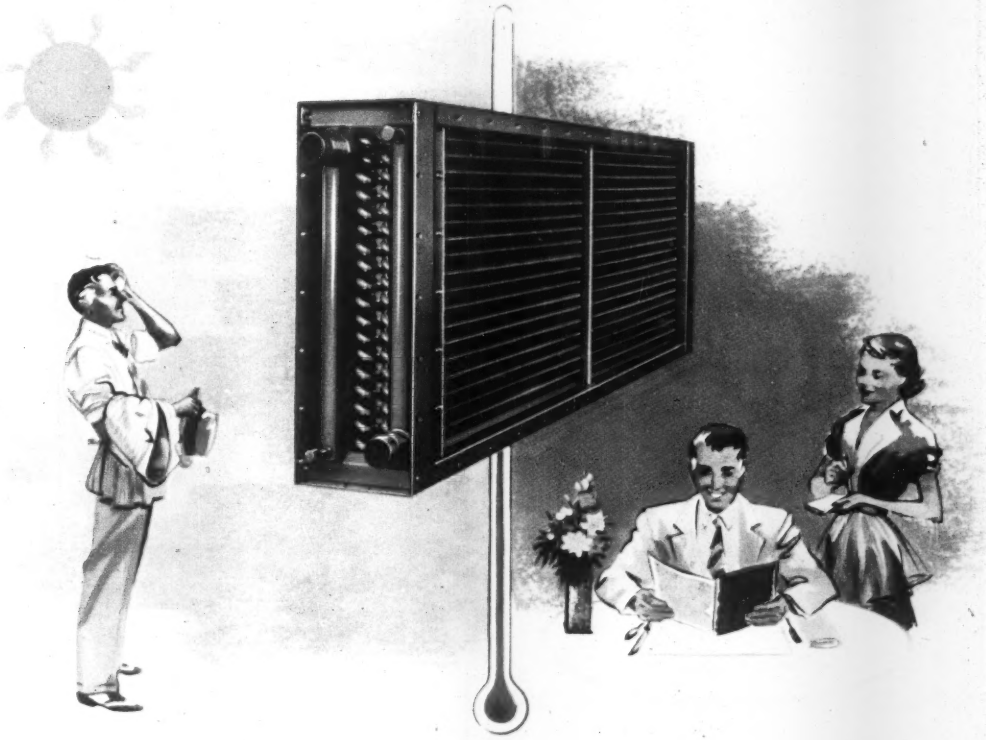
BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!

American Blower – a time-honored name in air handling



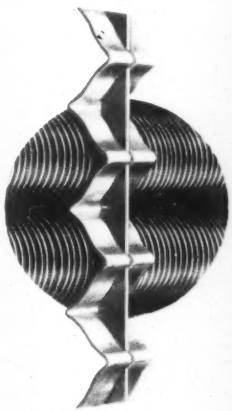
This American Blower Cooling Coil is the difference between stifling summer's heat and humidity and a delightfully refreshing atmosphere. It furnishes cool relief for the comfort of customers or workers in restaurants, stores, plants, or public buildings.

It is another one of the dependable high-quality products of American Blower—whose name on air handling or conditioning equipment is your assurance of lasting satisfaction.

Ask at our nearest Branch Office for details and data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



Three types of American Blower Cooling Coils are available: (1) *Type W Water Coils* for normal cooling and dehumidifying requirements, using refrigerated or naturally cold water; (2) *Type C Cleanable Water Coils*, recommended for any water supply which tends to deposit solids in tubes and headers; (3) *Type X Direct Expansion Coils* for use with directly expanded refrigerants. Shown at left is the die-formed tube support which protects tubes and forms a brace between casing channels. Write for Bulletin 1521.

AMERICAN BLOWER

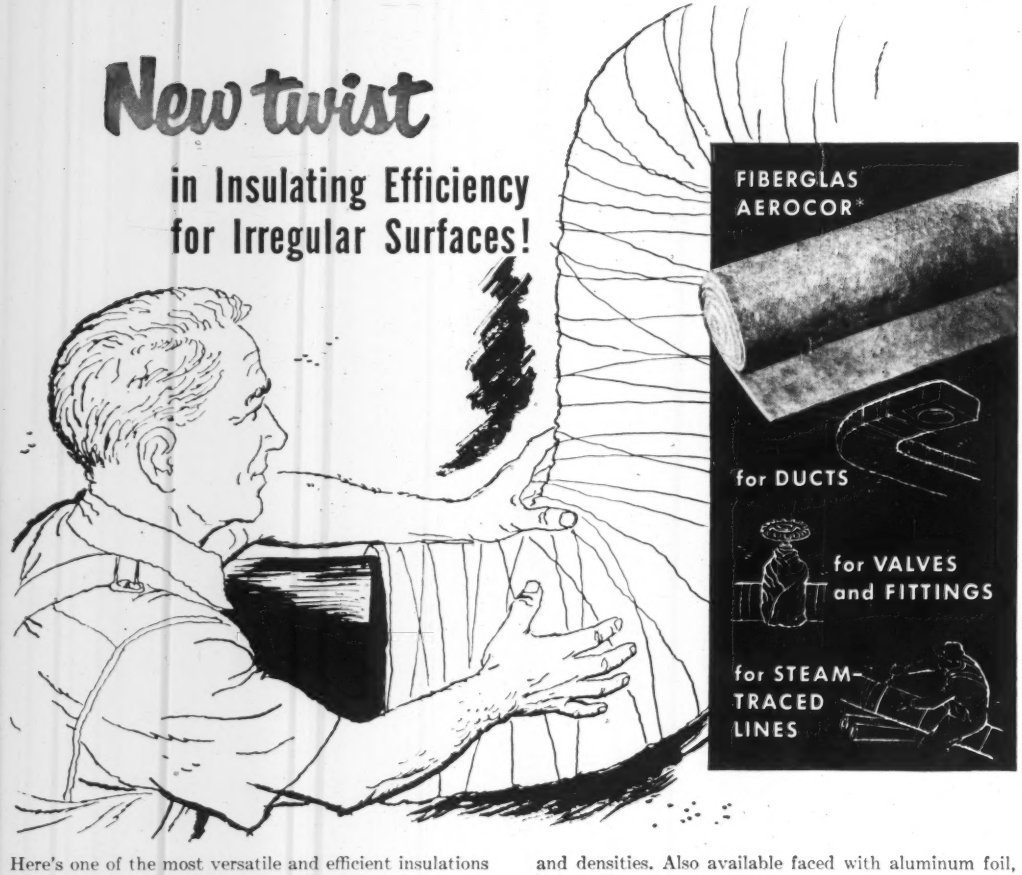
YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

New twist

in Insulating Efficiency for Irregular Surfaces!



Here's one of the most versatile and efficient insulations known to man . . . flexible, resilient Fiberglas* Aerocor . . . a "natural" for fast, easy application to irregular and hard-to-reach surfaces.

With a "k" as low as .23 at 75°F., plus excellent sound-deadening properties, Aerocor is ideal for round, rectangular or odd-shaped ducts. This new insulating blanket is made of superfine fibrous glass, weighs less than 1 oz. per sq. ft., 1 in. thick.

Aerocor's flexibility greatly simplifies insulation of valves, fittings, steam-traced lines. It is easy to cut with a knife or scissors. Can be quickly tied in place, taped, sewn or cemented. Comes in various widths, thicknesses and densities. Also available faced with aluminum foil, plastic film or reinforced paper.

Where heat or cold must be controlled, count on these unique features of Fiberglas Industrial Insulations to produce top results, in less time, at lower cost:

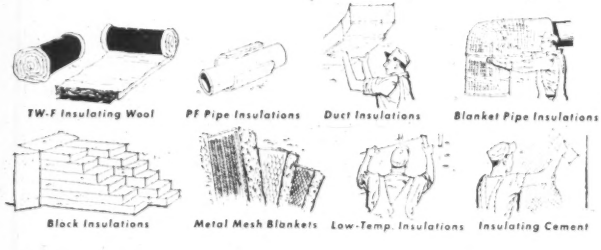
- High insulating value
- Light in weight
- Easy to cut and apply
- Economically priced
- Ageless, rotproof
- Non-corrosive
- Low moisture pickup
- Will not shrink

For local source of supply, see the yellow pages of your phone book, or contact the nearest Fiberglas office. OWENS-CORNING FIBERGLAS CORPORATION, Dept. 40-F, Toledo 1, Ohio.

OWENS-CORNING
FIBERGLAS

INDUSTRIAL INSULATIONS

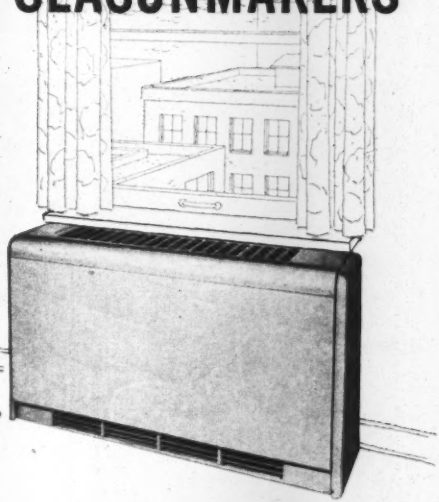
...Where Heat or Cold Must be Controlled!



*Fiberglas and Aerocor are trade-marks (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for products made of or with fibers of glass.

BIG NEW YORK HIT!

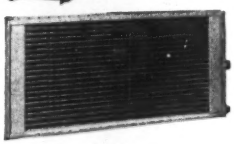
McQuay SEASONMAKERS



Commodore Hotel Installs "The Best" Individual Room Air Conditioning!

Cleanable Tube Coil

"J" Type Steam Coil, non-freeze



You can enjoy Air Conditioning at its best on your next visit to New York's Commodore Hotel. McQuay Seasonmakers, individual room Air Conditioners, have been installed for your comfort.

Also, McQuay Water Cooling and Steam Heating Coils provide the Air Conditioning in the Century Room, main lobby, ballrooms, and other parts of the Hotel.

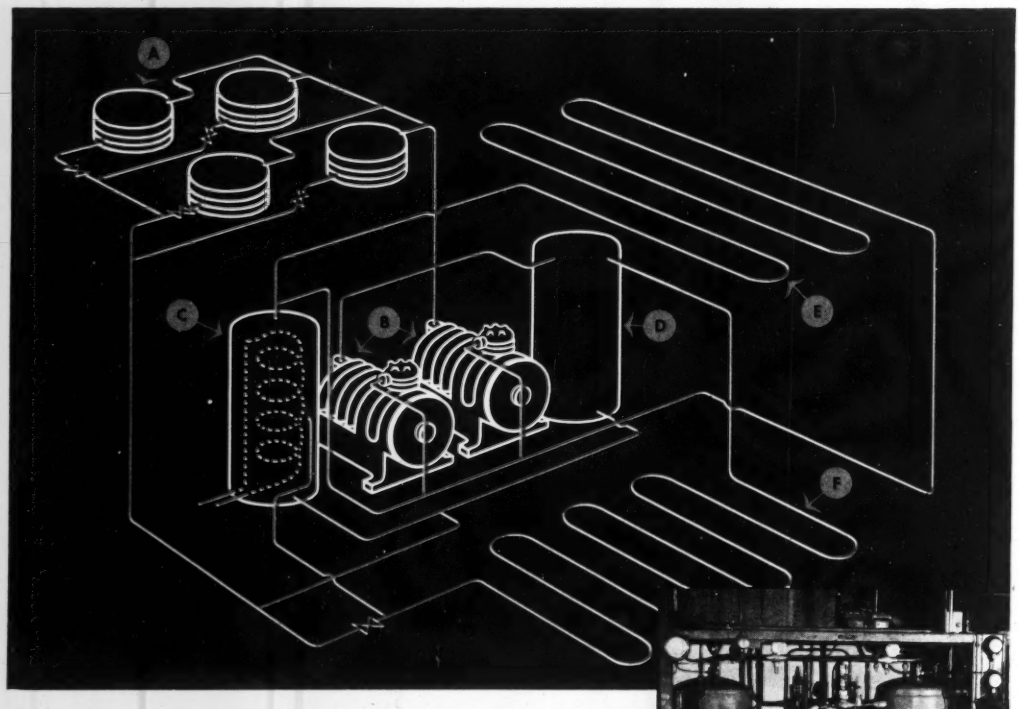
Frank A. McBride Co., New York, engineers and contractors, installed McQuay Seasonmakers on the fifth and sixth floors of the Commodore with not more than 20% of the rooms out of guest service at any one time.

Ripple-Fin construction of McQuay coils, an exclusive feature of McQuay air conditioning equipment, is the product of years of research that has produced the ultimate in heat transfer efficiency. Write for catalog. Representatives in principal cities. McQuay Inc., 1601 Broadway St., N.E., Minneapolis 13, Minn.

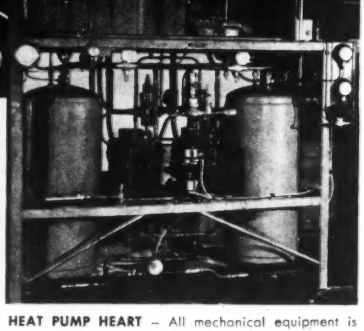
McQuay INC.

REFRIGERATION • AIR CONDITIONING HEATING

How ANACONDA copper "HEAT PUMP"



HOW IT WORKS — *Heat pump system in sausage plant removes heat from sausage with forced-air refrigerating convectors (a). Compressors (b) use Freon-12 refrigerant. 80-gallon heat exchanger tank (c) warms domestic water running through 300 feet of copper tubing. Surge tank (d) takes care of vapor or liquid refrigerant. 500 feet of copper tubing in office floors (e) provides radiant heat, and 1800 feet in basement floor (f) dissipates heat in summer, stores it for radiant heating on nights, weekends.*



HEAT PUMP HEART — All mechanical equipment is assembled as a packaged unit. Two 3-hp. compressors, plus automatic controls, are located between heat exchanger (left) and surge tank (right). Charles Charlton, Hartford, Conn., Designer.

for reliable service on Copper & Copper Alloys, call an ANACONDA distributor

tubes contribute to

success story

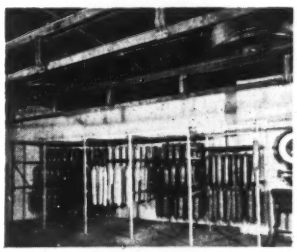
When both heating and cooling sides of a refrigeration system are put to work, it's a true heat pump *with important operating economies.* Here's an interesting example of such double duty. In the Hartford, Connecticut sausage plant of Mucke & Sons, process heat warms offices. ANACONDA Copper Tubing plays an essential part. Its excellent heat-transfer properties, corrosion resistance, and consistent uniformity make for high efficiency.

Primarily this system was designed to cool cooked sausage. However, it was apparent that *three* jobs could be done by the "heat" side. Designer Charles Charlton used heat removed from the sausage (1) to heat offices, (2) to provide washroom hot water, (3) as a reserve, stored underground, for use when sausage processing is not in operation.

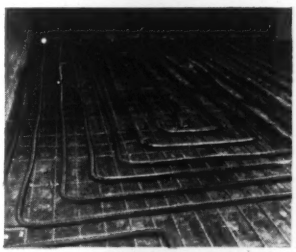
Nothing succeeds like success. Results have been so encouraging that Mucke & Sons are thinking of expanding the system to make further use of the heat.

If this installation interests you, we will gladly forward a complete description on request.

Your source of supply for Anaconda products is your regular wholesaler. For prompt, convenient and reliable service on all your requirements, be sure to call on him. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 5211 A



HEAT REMOVED – Corner of the sausage cooling room shows two of the circular convectors in the ceiling. Temperature is kept at 40° F. Cooler is 25 ft. x 35 ft. with a cooling load of 60,000 Btu per hour.



HEAT USED – Shown here is part of the 500 feet of copper coil embedded in concrete slabs in the floor of adjacent plant offices and other areas. This tubing circulates the refrigerant gas to furnish radiant heat.

modern piping calls for ANACONDA® copper tubes

BEEF WITHOUT "BEEFING"

...with cold controlled by Alco PO Thermo Expansion Valves

When a customer "beefs" about sluggish or erratic refrigeration control, chances are an ALCO THERMO VALVE will solve the problem. They efficiently control the flow of refrigerant with the aid of a small thermo pilot valve which opens and closes as the superheat increases and decreases.

PO VALVES are built for evaporators with capacities from 75 to 200 tons Freon-12. They are made with a minimum of parts and are easy to install and service.

Our PO VALVE BULLETIN gives complete technical and installation data. May we send you a copy?

SEE YOUR ALCO WHOLESALER

Designers and Manufacturers of Thermostatic Expansion Valves Evaporator Pressure Regulators Solenoid Valves Float Valves Float Switches

ALCO VALVE CO.

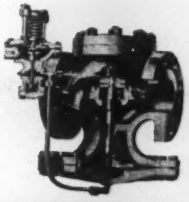
861 KINGSLAND AVE. • ST. LOUIS 5, MO.

Looks like we're using
SPENCE REGULATORS
all over our plant

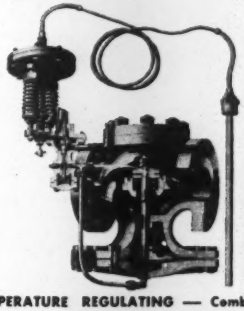
This busy plant has ordered and re-ordered Spence Regulators for two good reasons. (1) Spence offers a *wide-range line* to handle a host of regulating jobs. (2) What's more, Spence units give accurate service year after year. Maintenance is negligible. Over-all costs are low. These design features explain why . . .

- **Single Seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**

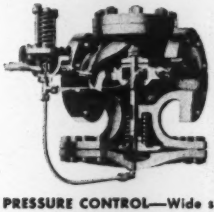
Write for Bulletin 350 for complete details on Spence's line of automatic regulating valves.



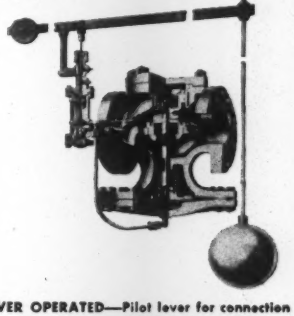
PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750F.



TEMPERATURE REGULATING — Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.



LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

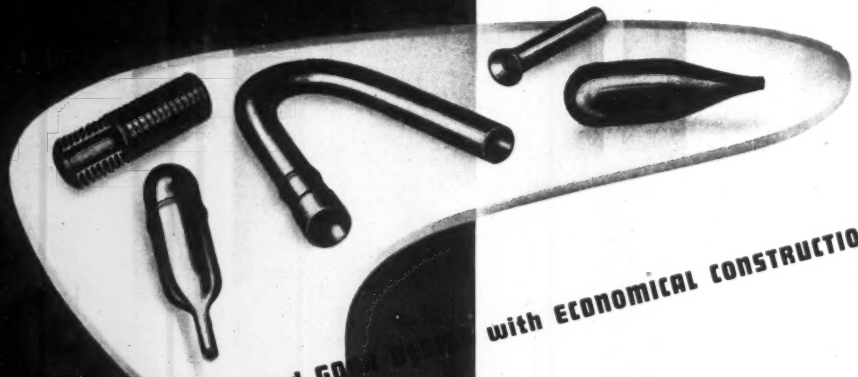
SE 110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

TUBULAR PARTS

THIRD OF A SERIES OF ADVERTISEMENTS THAT TELL ABOUT PRODUCTS THAT MEAN MUCH TO
HEATING, PIPING AND AIR CONDITIONING ENGINEERS



with ECONOMICAL CONSTRUCTION

Take advantage of Wolverine's specialized skill and experience to provide the fabricated tubular parts you require. Wolverine's vast knowledge coupled with the necessary special equipment that we have or can design to produce these parts most efficiently, leaves nothing wanting in supplying you tubular parts to meet your exacting demands for quality and economy.

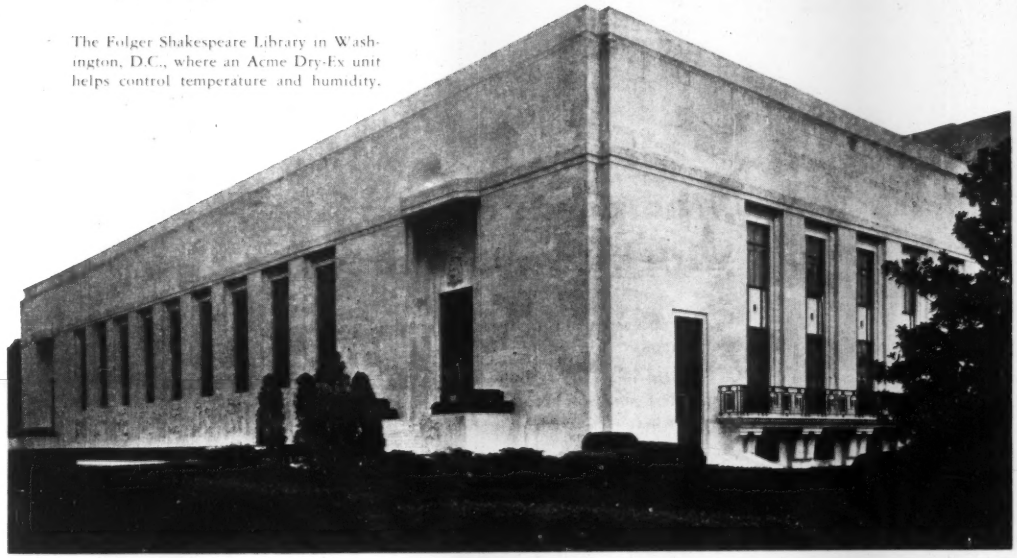
We invite you to consult our Customer Engineering Service which is always ready with a helping hand to work out problems of this nature.

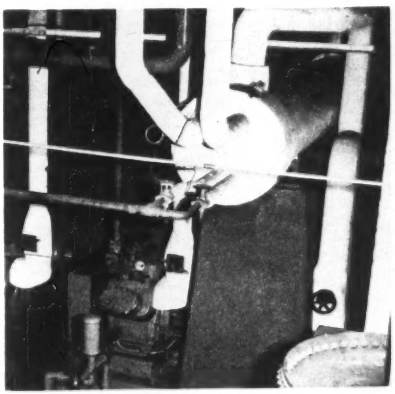
WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of seamless, nonferrous tubing
1419 Central Ave. • Detroit 9, Mich.

Wolverine Mill Depots:
DETROIT, MICH. • DECATUR, ALA. • HOUSTON, TEXAS • LOS ANGELES, CALIF.
LONG ISLAND CITY, N. Y. • PHILADELPHIA, PA. • PROVIDENCE, R. I. • ST. LOUIS, MO.

Acme DRY-EX CHILLER
helps safeguard
$10,000,000 SHAKESPEAREAN COLLECTION

The Folger Shakespeare Library in Washington, D.C., where an Acme Dry-Ex unit helps control temperature and humidity.





The Acme Dry-Ex Chiller installed at the Folger Library.

Extremely close year-round control of temperature and humidity is necessary for the protection and preservation of aged parchments and papers. The trustees of the Folger Shakespeare Library in Washington, D. C., recognized this fact in connection with their $10,000,000 collection of literature of the Shakespearean period including 79 of the first folios. The history of Western civilization for the 200 years before 1700 is completely recorded in this collection — one of the greatest in the Western Hemisphere.

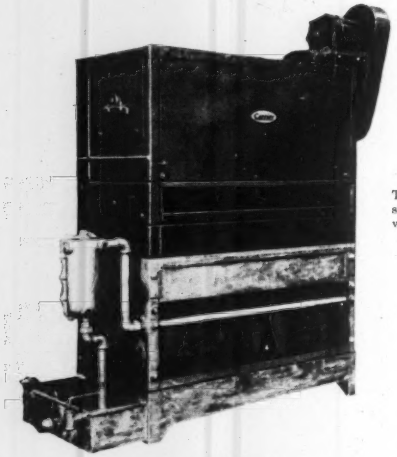
The thousands of volumes are located in vaults and rooms spread all over the large building. One room is a full size replica of a 17th century theater. It seats about 200 people and at times has performances held in it. Such variations in space, distance and occupancy placed a heavy load on any air conditioning system installed.

The installation finally decided upon was engineered and designed by the Griffith Consumers Company. It is a 100-ton chilled water air conditioning system that has as one of its component parts a 20" by 14' Acme Dry-Ex Water chiller. This unit was selected for its easy adaptability to variable loads and for its life-long assured, dependable performance.

ACME INDUSTRIES, INC.
FLOW COLD DIVISION
Jackson, Michigan

ACME PRODUCTS

CONTINUOUSLY SERVING THE AIR CONDITIONING AND REFRIGERATION INDUSTRIES SINCE 1919



The Carrier Industrial Weathermaker. Available in five sizes, this unit is matched in size and performance to work with a full line of Carrier refrigerating equipment.

Who needs air conditioning with year-round humidity control?

If you need a unit for year-round temperature-humidity jobs, here's good news.

It's the new Carrier Industrial Weathermaker — ideal for textile and paper test rooms, pharmaceutical laboratories and hospital operating rooms where close control of temperature *and* humidity is required.

A spray coil unit, the Industrial Weathermaker cools, dehumidifies, heats and humidifies. The coil is direct expansion or chilled water. The sprays are recirculated and can be heated with a steam spraywater heater, which is a standard component.

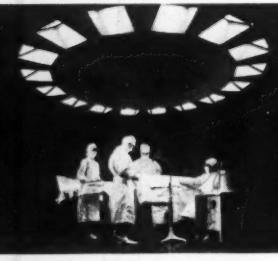
And this Weathermaker was built to be installed where quiet is called for. Its fan section is thermally and acoustically insulated, and is perfectly balanced to avoid vibration.

Designed for easy servicing, the Industrial Weathermaker's parts are accessible . . . like float valves being located in the sump section.

Designed for easy installation, its standard arrangement will save you field work and allow you to do an excellent low-cost job. Write and let us tell you more. Carrier Corporation, Syracuse, New York . . . *for 50 years — the people who know air conditioning best.*

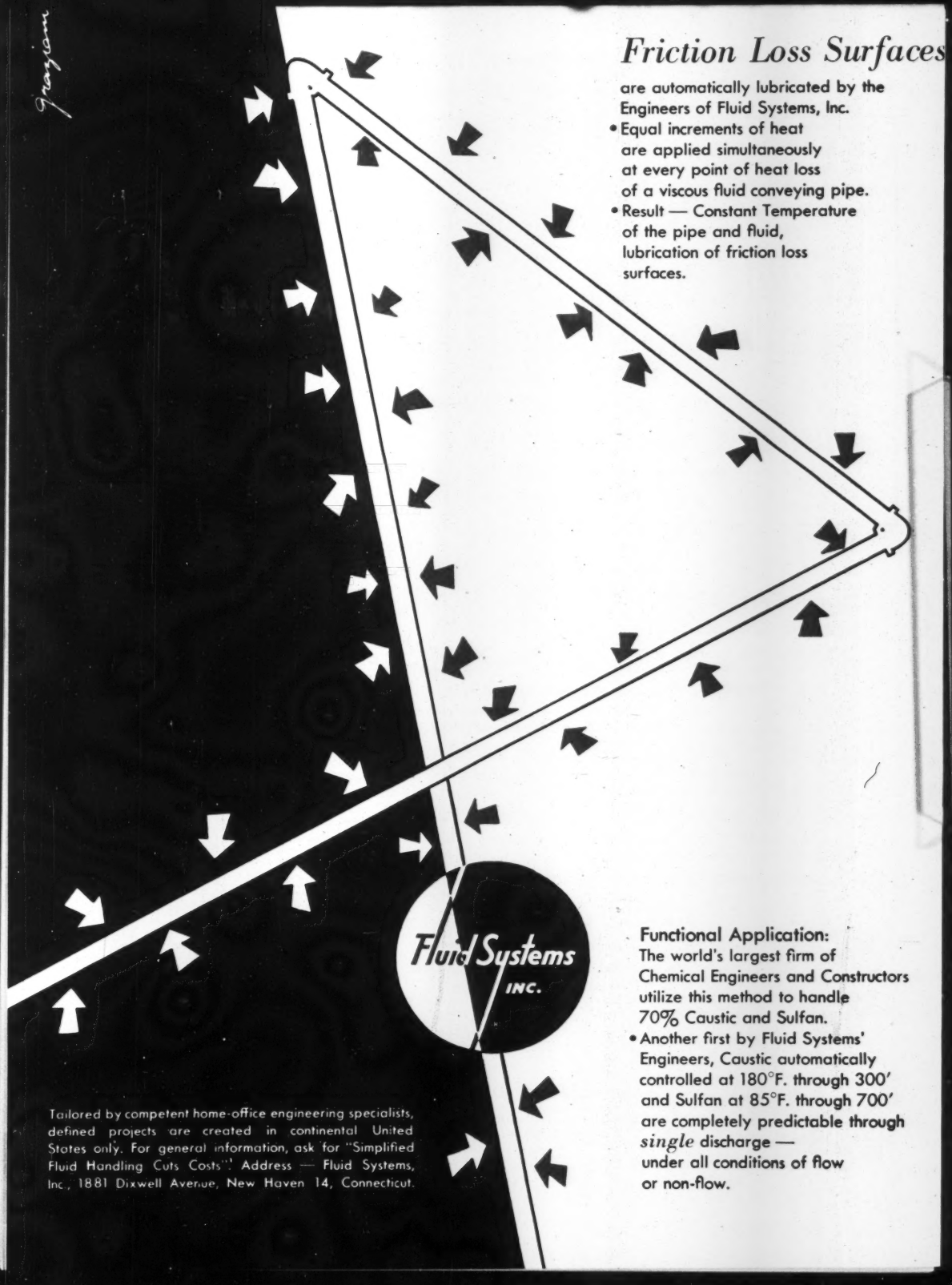
Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

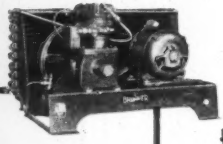


To reduce danger of explosions from static sparks, hospital operating rooms require the close humidity control offered by the Carrier spray-type Weathermaker.

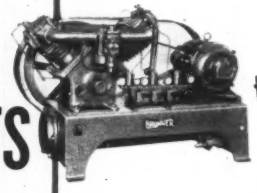
Testing laboratories, too, need accurate temperature-humidity control. The Industrial Weathermaker is available in five sizes, from 4100 to 16,400 cfm.


Friction Loss Surfaces
are automatically lubricated by the Engineers of Fluid Systems, Inc.
• Equal increments of heat are applied simultaneously at every point of heat loss of a viscous fluid conveying pipe.
• Result — Constant Temperature of the pipe and fluid, lubrication of friction loss surfaces.
Fluid Systems INC.
Functional Application:
The world's largest firm of Chemical Engineers and Constructors utilize this method to handle 70% Caustic and Sulfan.
• Another first by Fluid Systems' Engineers, Caustic automatically controlled at 180°F. through 300' and Sulfan at 85°F. through 700' are completely predictable through *single* discharge — under all conditions of flow or non-flow.
Tailored by competent home-office engineering specialists, defined projects are created in continental United States only. For general information, ask for "Simplified Fluid Handling Cuts Costs". Address — Fluid Systems, Inc., 1881 Dixwell Avenue, New Haven 14, Connecticut.

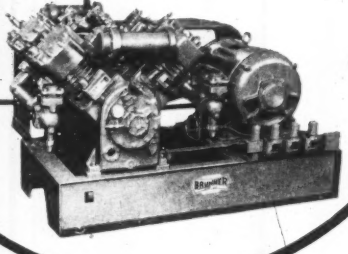
BRUNNER REFRIGERATION CONDENSING UNITS give you all 3!



the performance you depend on



the economy you want



the size you need

Three reasons "Brunner Quotes" get you orders!

PERFORMANCE that you get only with units that are soundly engineered, rugged, and precision manufactured. Slow-speed "open type" compressors, extra deep cylinder cooling fins, fan type flywheels, oversize condensers and a score of other Brunner features that reflect constant engineering research and years of proven success.

ECONOMY that is recognized by thousands of users of commercial and industrial refrigeration and air conditioning. Men who watch operating and maintenance costs are Brunner's strongest boosters.

SIZES designed to fulfill your customers' needs from the air conditioning of large buildings, to holding meat at sub-zero temperatures, or keeping beverages cool. Sixty-nine air and water cooled models—¼ hp. to 75 hp.—for single or multiple unit installations.

And a big PLUS... effective field help whenever you want it!

The new illustrated Brunner catalog gives you easy-to-use application data for determining the equipment you need for low cost, high efficiency air conditioning and refrigeration. But that's only part of the story. Why not get details of the Brunner proposition now? Write, wire or phone us today.

BRUNNER SINCE 1906

REFRIGERATION AND AIR CONDITIONING

BRUNNER MANUFACTURING CO., UTICA 1, NEW YORK, U. S. A.

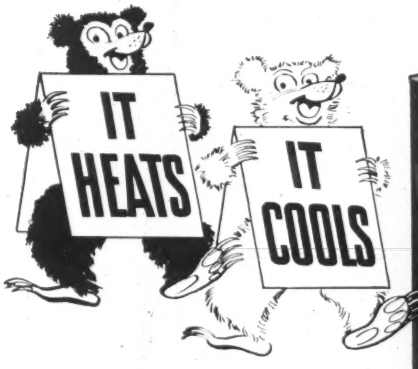
BRUNNER SINCE 1906

AIR CONDITIONING
Self Contained Units to 10 hp.
For remote installation...Brunner Condensing Units to 75 hp.

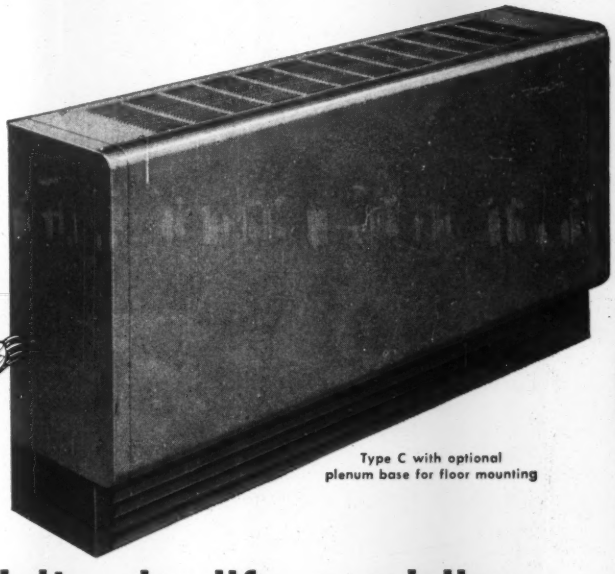
REFRIGERATION
Condensing Units from ¼ hp. to 75 hp. 69 Air and Water Cooled Models.

AIR COMPRESSORS
Single stage ¼ hp. to 2 hp. Two stage 1½ hp. to 15 hp. Horizontal and Vertical Models.

Don't let old-fashioned radiators stymie modernization plans



IDEAL FOR STORES, SHOWROOMS, SCHOOLS, BANKS, HOTELS, HOSPITALS, THEATERS, CHURCHES, OFFICES, VESTIBULES AND OTHER COMMERCIAL AND PUBLIC BUILDING AREAS



Type C with optional plenum base for floor mounting

Modine Cabinet Units simplify remodeling... save space...permit addition of cooling

WHAT YOU GAIN

when you replace old-fashioned radiators with Modine Cabinet Units

SPACE	Cabinet Units occupy only a portion of space taken by radiators.
CONCEALMENT	Cabinet Units can be built-in or installed outside of rooms served.
COOLING	You can have both heating and cooling in a single unit.
VENTILATION	Attachment of optional plenum-damper base permits fresh air introduction.
AIR CIRCULATION	Quiet blower fans provide positive air distribution.
APPEARANCE	Attractively styled cabinets blend with modern decor.

THERE'S no need to accommodate unsightly, existing radiators in modernization work. One attractive Modine Cabinet Unit can replace up to three or more radiators... frequently with no change in piping.

Mounted on the floor, wall or ceiling, Cabinet Units take little space. When installed with ducts they can be completely concealed above a false ceiling or behind a partition.

Where desired, chilled cooling and hot water heating can be provided with a single unit for year 'round comfort. Other models for steam or hot water heating only. Fresh air introduction is possible through use of an optional plenum base.

Not as elaborate or expensive as unit ventilators or air conditioners, Modine Cabinet Units are economical to use. What's more, the scrap value of the radiators they replace defrays part of their cost. (For example, a 280 lb. Modine Cabinet Unit replaces 3200 lbs. of cast iron radiation.) Available in five sizes from 120 to 640 Edr.

For complete information write for free illustrated Bulletin 550. Modine Manufacturing Company, 1509 De Koven Ave., Racine, Wis.

C-1149

WRITE FOR FREE BULLETIN 550

Modine
CABINET UNITS
FOR HEATING & COOLING

GOOD REMEDY for business ailments

Many of the big pharmaceutical houses use Worthington air conditioning and refrigeration machinery to control chemical reactions, inhibit bacteria, prevent deterioration.

And many a corner drug store keeps up "hot weather" business by using Worthington air conditioning to bring in customers.

No other manufacturer makes *so complete* a line. A Worthington system is all Worthington-*made* — not just Worthington-assembled — assuring you of perfectly balanced operation and unit responsibility.

Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Air Conditioning and Refrigeration Div., Harrison, N. J.

America's Leaders... in Many Businesses... Select

WORTHINGTON

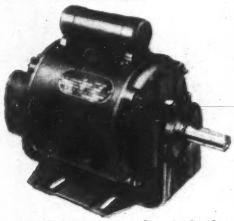
A.2.8

AIR CONDITIONING AND REFRIGERATION

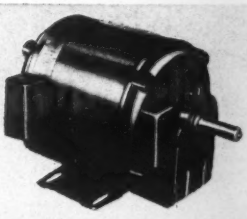
The Most Complete Line... Always the Correct Recommendation

Wagner
ELECTRIC MOTORS
... the choice of leaders in industry

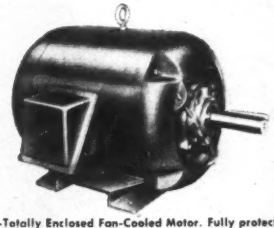
If *dependable* motor performance is a "must" for your product . . . specify Wagner



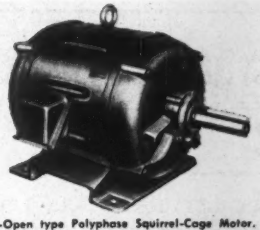
TYPE RK—Capacitor-Start Induction. For single-phase general purpose applications requiring high starting torque—normal starting current. Economical to maintain . . . requires minimum servicing . . . free from vibration and noise . . gives years of service. ⅛ to 3 hp.



TYPE RA—Repulsion-Start Induction. For general purpose applications with high starting torque—low starting current. No other single-phase motor has its ability to continually start heavy loads, or to stand up under long and frequent starting periods. ½ to 15 hp.



TYPE CP—Totally Enclosed Fan-Cooled Motor. Fully protected against filings, steel chips, grit, abrasives, or fumes. Requires no maintenance other than periodic lubrication. Also available in explosion proof type HP. 1 to 250 hp.



TYPE RP—Open type Polyphase Squirrel-Cage Motor. Steel frame—completely drip-proof in any horizontal position, in frames 326 and smaller—available with either sleeve or ball bearings which may be relubricated when necessary. For all general purpose applications. ⅓ to 400 hp.

4 GOOD REASONS WHY-

1. Wagner Motors, for over sixty years, have established unexcelled records for continuous, troublefree performance.

2. Wagner Motors are well-known for their superior quality and their sturdy design and construction.

3. The many types of motors and motor modifications in the standard Wagner line helps the designing engineer in his selection of the right motor for the job.

4. Users of Wagner Motors are assured of fast service through Wagner's nation-wide service organization of 26 Wagner-owned Service Branch Warehouses and more than 650 Authorized Service Stations which provide on-the-spot service, replacement motors, or genuine Wagner motor repair parts.

The wide range of types and sizes of Wagner motors permits the selection of a trim, compact standard motor to meet your definite needs. Bulletin MU-185 gives full information on the complete line. Write for your copy.

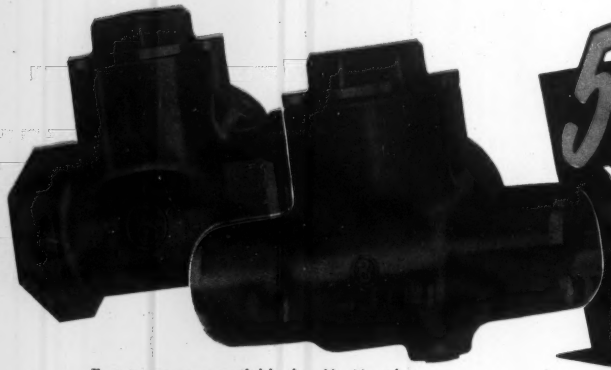
®Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M52-15

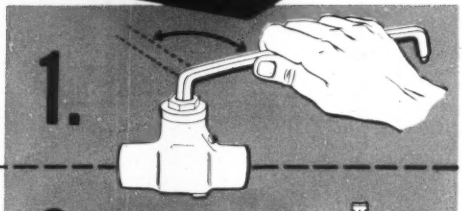


5 REASONS WHY..

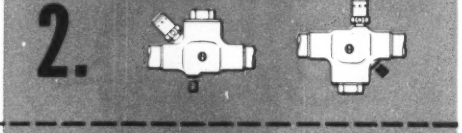
YOU SHOULD SPECIFY EQUA-TEMP BALANCING VALVES For Hot Water Radiant Heating Systems

Equatemps are available for ¾, ½ and ¾-inch tubing or for ¾, 1, 1¼ and 1½ inch threaded pipe.

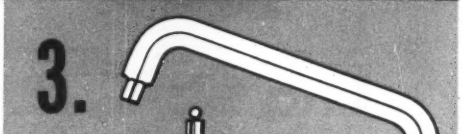
EQUATEMPS ARE EASY TO REGULATE—Full open to closed in quarter turn of stem. Equatemps are absolutely leaktight, allowing complete shut-off of individual lines.



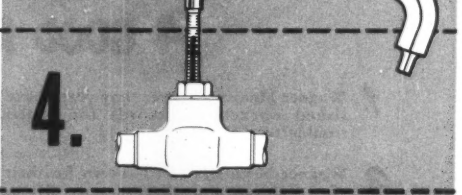
DRAINING AND VENTING POSSIBLE—Equatemps are fitted with two drain plugs, one in top and one in bottom. Venting or draining is possible in either upright or inverted position.



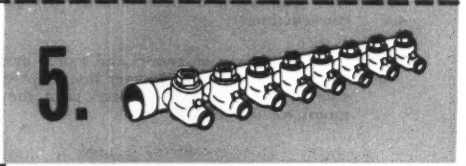
CONTROL SETTINGS ARE TAMPER-PROOF—Tampering is discouraged by settings which can be locked once the system is properly balanced. To change settings requires special key or two different Allen-type wrenches.



INTEGRAL THERMOMETER WELL PROVIDED—Equalizing temperature of water in return lines is quick and effective method to balance system. The thermometer well drilled in valve stem is a handy place to take accurate temperature readings.



COMPACT AS WELL AS VERSATILE—Eight Equatemp solder-type valves can be manifolded in space 18-inches wide. Manifold units are available with 3 or 4 outlets—can be slipped together to form headers of any desired length.



For additional information on Equatemp Valves and Manifold units, send in this coupon requesting Equatemp folder 1214V.

Name .....

Company .....

Street .....

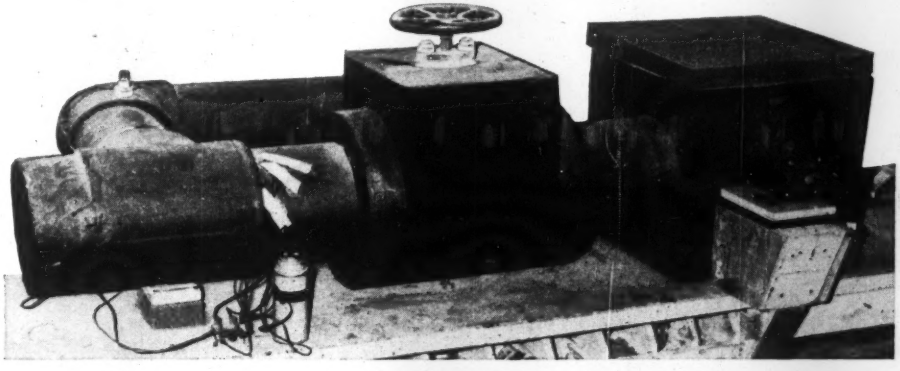
City ..... State .....

4210-V

Ohio Brass

MANSFIELD • OHIO

ON THIS APPARATUS, 3" FOAMGLAS Pipe Covering was tested for a period of one year, cycling between *minus* 100° *and plus* 350° F. The test was designed to accelerate any deterioration that might occur under actual field conditions. A total of 52 cycles was completed, with no loss of insulating efficiency.



THIS DUAL-TEMPERATURE TEST PROVED

"No loss of insulating efficiency"

● Its ability to withstand *both* extremely low and high temperatures —over long periods of time—has won wide preference for FOAMGLAS among plant engineers for low and dual-temperature requirements. It is being used successfully on piping, valves and fittings, heat exchangers, towers, tanks, boilers and other process equipment. FOAMGLAS has also proved its effectiveness as structural insulation in walls, floors and roofs, for both normal temperature and refrigerated space.

The insulating efficiency and durability of FOAMGLAS are due to its cellular glass construction, which prevents moisture and other harmful elements from getting into the material. So it will not get soggy, slip out of place, rot or shrink, as do ordinary materials which constantly need costly maintenance and finally have to be replaced.

Get the latest information on FOAMGLAS whenever you need insulation. Just send the coupon for a sample of the material and copies of our authoritative booklets.

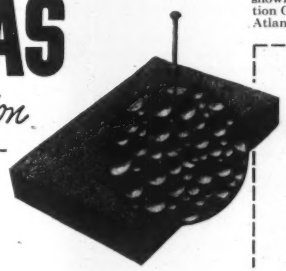
PITTSBURGH CORNING CORPORATION • PITTSBURGH 22, PA.

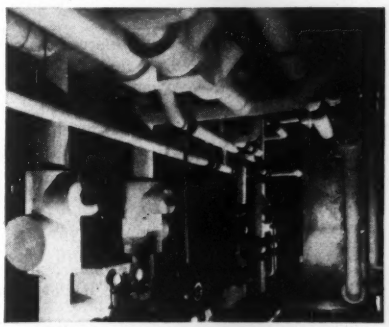
PITTSBURGH PC CORNING

FOAMGLAS®

the cellular glass insulation

The *best* glass insulation is cellular glass. The only cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, verminproof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.





FOAMGLAS insulates these dual-temperature lines used for cooling and heating the new Citizens & Southern National Bank building, Atlanta, Ga. A canvas and paint finish is shown on the insulation. General Contractor: Beers Construction Co., Atlanta, Ga. Insulation Contractor: North Brothers, Atlanta, Ga.

Pittsburgh Corning Corporation
Dept. AF-62, 307 Fourth Avenue, Pittsburgh 22, Pa.

Please send me, without obligation, a sample of FOAMGLAS and your FREE booklet, on the use of FOAMGLAS for Normal Temperature Commercial, Industrial and Public Buildings ☐ Refrigerated Structures ☐ Piping and Process Equipment. ☐

Name .....

Address .....

City ..... State .....

THE GREAT NEW AMERICAN
FLAG SUPERLINER

S.S. UNITED STATES

IS EQUIPPED WITH FLUSH KLEEN SEWAGE EJECTORS

Built for United States Lines by the Newport News Shipbuilding and Drydock Company, Gibbs & Cox, Naval Architects under auspices of the United States Maritime Administration.

The new S.S. United States, the largest, fastest and safest superliner ever built in this country, is equipped with many duplex sets of FLUSH-KLEEN EJECTORS (more than enough sewage pumping capacity to meet the need of a good-sized town).

FLUSH-KLEEN EJECTORS were selected on a proven record of ship performance . . . since 1936 they have been giving *trouble-free service, clog-proof operation* and *low-cost maintenance* on numerous troop transports, cargo ships, hospital ships, as well as on the "America", now our country's second largest passenger ship.

The selection of FLUSH-KLEEN EJECTORS for the new "United States" reflects the acceptance that these units have gained from engineers who design pumping stations for commercial or industrial plumbing systems, and municipal lift stations—*as more than 5,000 Duplex Flush Kleen Ejectors are now in operation in plants the country over.*

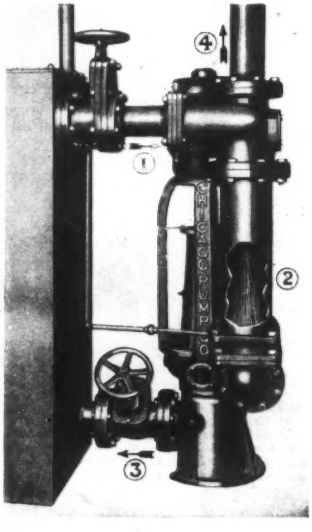
If you do not have all the facts about FLUSH-KLEEN EJECTORS, please request Bulletin No. 122—it will be sent to you promptly.

The positive clog-proof operation of FLUSH-KLEEN EJECTORS is readily understood by referring to the cut-away illustration.

FILLING WET WELL—(1) Sewage flows through inlet pipe. (2) Sewage solids are retained by strainer. (3) Strained sewage flows through idle pump to basin.

PUMPING—(3) Strained sewage is pumped from basin. (2) Sewage solids are backwashed from strainer. (4) Special check valve closes; sewage and solids are pumped overboard.

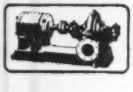
CHICAGO INDUSTRIAL PUMPS



CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY **CHICAGO 14, ILLINOIS**

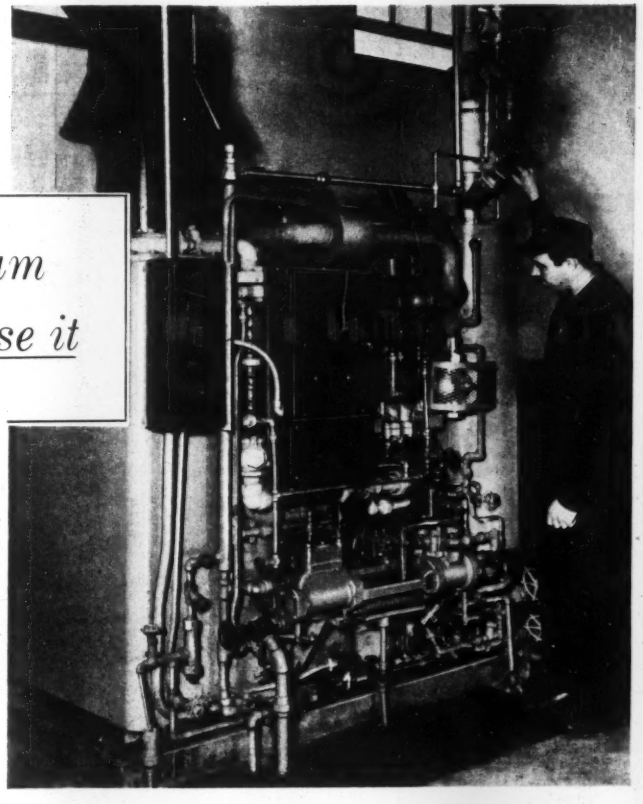


Cande-Vac, Sure Return AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

Make your steam
where you use it
with this . . .

PUSH-BUTTON STEAM PLANT



Just push the button — and in a matter of minutes the C-E Re-circulation Steam Generator will give you up to 6,000 pounds of steam per hour at up to 300 psi. That's just about all there is to it.

For the C-E Re-circulation Steam Generator is more than a package boiler — it is a fully integrated, fully automatic, steam plant complete with all controls and accessories, and it takes a minimum floor space . . . about the same as two office desks.

If you have a space 7 feet square by 8 feet high and you need steam for . . .

. . . remote spots not served by present steam lines, or involving long, wasteful pipe lines

. . . occasional loads that exceed the capacity of your present steam generating equipment

. . . highly fluctuating loads and those involving sudden heavy demands

. . . any conditions requiring maximum output from minimum space, with minimum attention.

If you do — or wherever you need a compact . . . reliable . . . automatic source of steam for heat or process — don't just buy a boiler — investigate the C-E Re-circulation Steam Generator. You'll find further details in bulletin p-323a. May we send you a copy?

IF COAL IS YOUR FUEL . . .

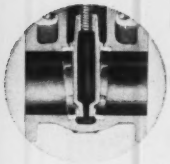
. . . investigate the C-E Skelly Stoker for best results with either bituminous or anthracite.

COMBUSTION ENGINEERING — SUPERHEATER, INC.

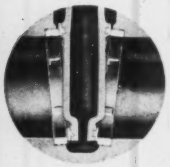
200 Madison Avenue • New York 16, N. Y.

B-581

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.

Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

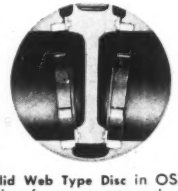
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

Bronze Back-Seat Bushings in bonnets of OS&Y valves.



Solid Web Type Disc in OS&Y valves for greater strength and longer service.

Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

These Marks Create Confidence

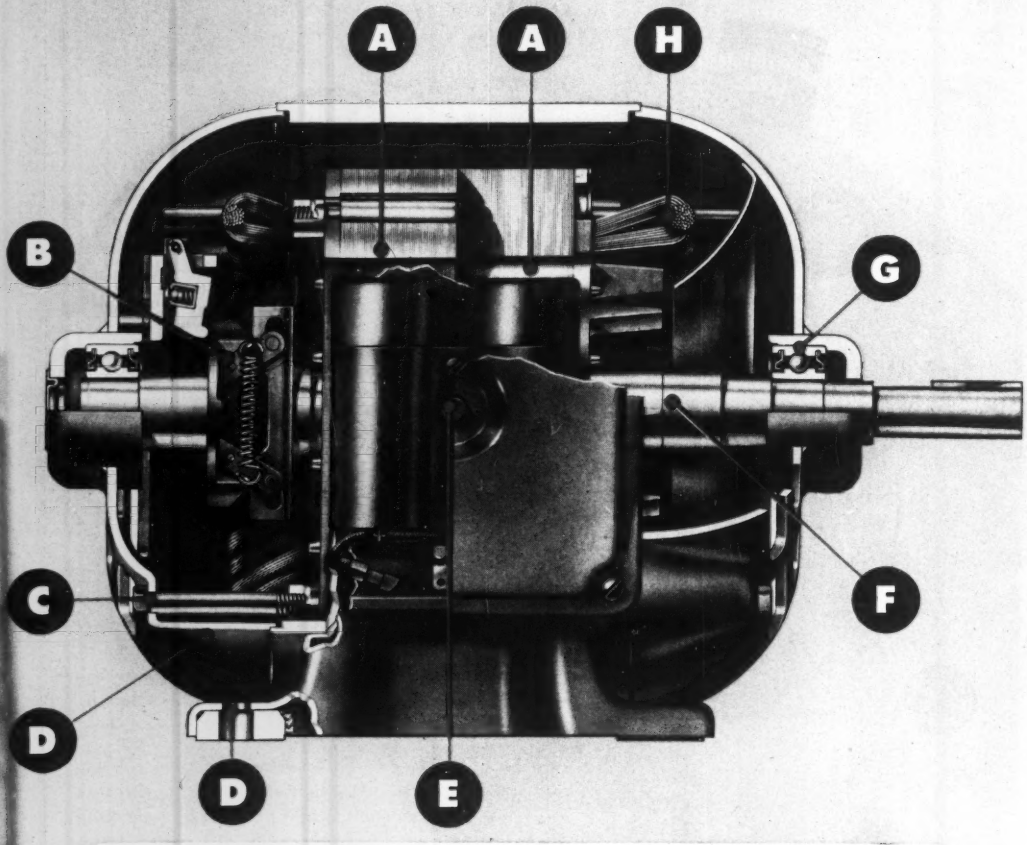
Those who buy goods or services bearing the marks of well-known organizations such as those shown here, do so with understandable confidence. And *every one* of these representative leaders in American industry has expressed *its* confidence in Zallea Expansion Joints by *buying* them not only once, but by issuing repeat orders!

Would you be interested in knowing why we enjoy this nationwide preference? The answer is easy. It is because the value in an expansion joint is in direct proportion to the length of trouble-free service life. The records prove that Zallea Joints stand-up where others fail.

There is a Zallea Stainless Steel Expansion Joint for every service need—in diameters from 3″ to 30′0″—pressures ranging from vacuum to 2000 psi—and temperatures from sub-zero to 1600° F. For full details regarding your expansion joint problems or requirements, just get in touch with us. Zallea Brothers, 816 Locust Street, Wilmington 99, Delaware.

Catalog 47 and Bulletin 351 describe the complete line of Zallea Expansion Joints and Flexible Connectors. Write for a copy today.

Zallea
EXPANSION JOINTS



UNDER COVER OF STEEL...LIE THESE FEATURES:

A Capacitors . . . provide ample starting and running torque.

B Centrifugal Switch . . . disconnects starting winding automatically on lower horsepower motors.

C Restricted Ventilating Openings . . . protect against entrance of dripping liquids and other foreign material.

D All Steel Frames, Feet and Brackets . . . assure rugged, protective construction.

E Thermoguard® (available as extra up to 2 hp) . . . gives dependable overload protection.

F Dynamically Balanced Rotor . . . provides vibration-free operation.

G Pre-lubricated, Factory-sealed Bearings . . . have grease sealed in—dirt sealed out. No greasing schedules! No bearing failure from faulty lubrication!

H Tuffernell Insulation . . . guards against damage from moisture, abrasives and mild chemicals.

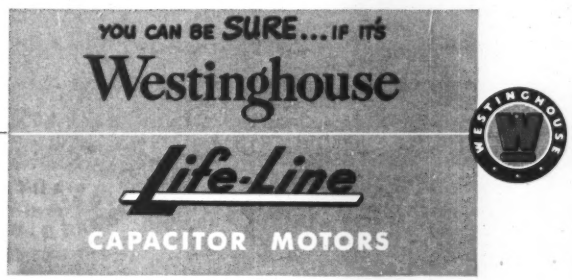
Your High Torque...
Low Maintenance Answer
FOR SINGLE-PHASE JOBS

Meet high torque demands on single-phase jobs with Westinghouse CAP motors. Their ample breakaway torque and running stamina master your toughest applications. Built-in capacitors, one of many CAP motor features, account for full-power starting.

Apply CAP motors and forget maintenance problems! They're designed for trouble-free operation. Bearings are pre-lubricated, factory-sealed. A feature which eliminates greasing schedules and prevents bearing burnouts from faulty lubrication. You're assured many years' service with no bearing attention.

Here are more trouble savers! Die-cast rotors . . . no brushes to adjust or replace, no windings to fail and cause breakdown. Rugged steel construction... gives high shock resistance for these small, light motors. Tuffernell® insulation . . . assures protection against moisture, abrasives and mild chemicals.

Learn the many other features included in power-packed Westinghouse capacitor motors. Ask your Westinghouse representative or write for free booklet, J-21676, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21676



"WE WON'T NEED THE UMBRELLA ANY MORE, DEAR.
THEY INSTALLED **READING COPPER TUBING**
TODAY. THERE WON'T BE ANY MORE LEAKS!"

Today, of course, much of our production of long-wearing Reading Copper Tubing is earmarked for essential defense orders. But, you can count on our continued cooperation to keep you supplied with as much tubing for civilian use as government restrictions permit.

READING COPPER TUBING

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

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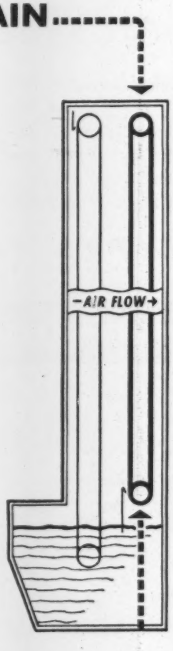
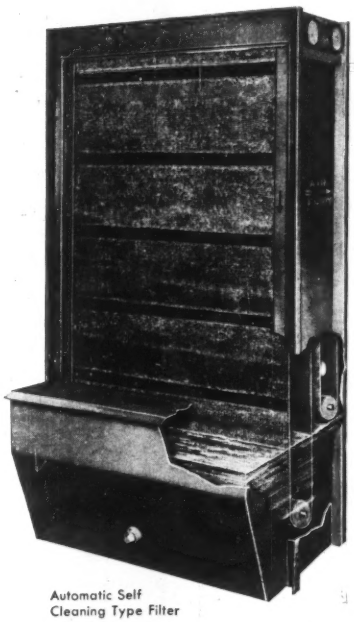
GET DOUBLE PROTECTION!

ONLY STAYNEW

AUTOMATIC AIR FILTERS HAVE THIS DRY CURTAIN.....

Staynew Model A-3 Automatic is the only air filter designed to give the *double protection* of double filter curtains — the first wet, the second dry. There's never oil entrainment and the cleaned side of curtains is always on the filtered air side. Staynew Model A-3 Filters are designed for both light dust load installations and for heavy duty industrial service where large volumes of air are to be filtered.





Automatic Self Cleaning Type Filter

- Highest efficiency of any mechanical type automatic filter.
- Exceptionally large dust holding capacity.
- Absolutely no oil entrainment in air stream.
- Motor and control unit mounted on clean side of filter.
- Combination gear and roller chain drive (no belts to slip).

Bring your filtration problems to Staynew. If the filtration of large volumes of dirty air at high efficiency and low cost is required, let the Dollinger engineers show you how and why Staynews are your answer. Write for descriptive folder.

Representatives in Principal Cities

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

9 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Look for Economy
WHEN YOU BUY HEATING PUMPS

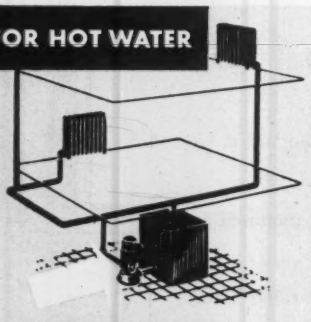
WHEELER-ECONOMY HEATING PUMPS
with Better-Than-Ever Engineering and Quality Control

With the consolidation of Economy Pumps, Inc. and C. H. Wheeler Manufacturing Company, the heating pumps you have always bought as "the best in the field" will now be sold as WHEELER-ECONOMY HEATING PUMPS. Representatives are being appointed in key areas to give you good service with a time-honored line of heating pumps that is now *better than ever.*

The Wheeler-Economy line of heating pumps has undergone a complete engineering check-up and reanalysis from the castings out. Many refinements have been made and a new face-lifting has been effected . . .

TYPES FOR EVERY BASIC HEATING PROBLEM

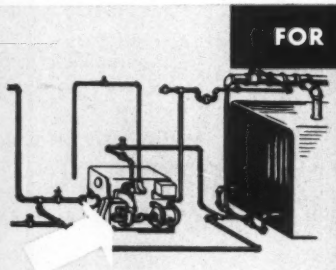
FOR HOT WATER



HOT WATER CIRCULATION

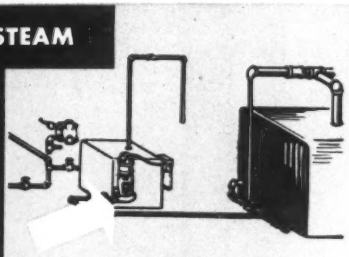
Wheeler-Economy Circulating Pumps deliver hot water to radiators quickly and return warm water to boiler with high efficiency.

FOR STEAM



STEAM VACUUM

The Wheeler-Economy Vacuum Pumps employ the most efficient design ever devised for removing air and water from condensate return lines.



RETURN CONDENSATION

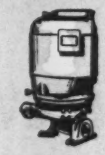
Wheeler-Economy Condensation Pumps give outstanding performance in a compact dependable design.

WHEELER-ECONOMY HOT WATER CIRCULATING PUMPS

Type SCV—Vertical direct connected centrifugal pump. Sizes 1″ to 3″. Capacities to 500 GPM. Various RPM speeds 1150 to 3450. Heads to 225′.

Type SCC—Close coupled vertical or horizontal mounted. Sizes 1½″ and 2″. Capacities to 100 GPM. 3450 RPM. Heads to 120′.

TYPE SCV



TYPE SCC

WHEELER-ECONOMY VACUUM PUMPS

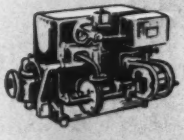
Type VV—Vertical Vacuum Pumps—Suitable for use on all ordinary jobs operating between 3 and 12 inches of vacuum. Made for all discharge pressures up to 150 lb. per sq.in. Capacity sq.ft. E.D.R. 2500 to 15,000. Single and duplex units.

Special Capacities—VVS and VVSD single and duplex units recommended wherever capacity of system or air leakage is greater than ordinary. Also where lifts or pockets in the returns necessitate carrying higher vacuum. (Example: 10 to 16 inches.)

Type SVA—Horizontal Vacuum Pumps—For ordinary jobs operating between 3 and 12 inches of vacuum. Discharge pressures up to 150 lb. per sq.in. Capacity sq.ft. E.D.R. 20,000 to 100,000. Single and duplex units.

Special Capacities—Styles SVS single unit and DVS Duplex Unit, recommended where air capacity or air leakage in the system is greater than ordinary. Also where lifts or pockets in return require the carrying of higher vacuum—example 10 to 16 inches.

TYPE VV



TYPE SVA

WHEELER-ECONOMY RETURN CONDENSATION PUMPS

Type E—Operate at 1750 RPM or for 50 cycle current at 1440 RPM. The best pump where extremely quiet operation is desired. Single and duplex units. Capacity sq.ft. direct C.I. radiation or equivalent: 1000 to 65,000.

Type EC—Available for the same or higher pressure than handled by Type E pumps. Operate at 3450 RPM. Units for 50 cycle current operate at 2880 RPM. Capacity sq.ft. direct C.I. radiation or equivalent 1000 to 65,000. Single and duplex units.

Vertical Underground Pump—Used where returns are below floor level or otherwise too low for horizontal pumps. Cast Iron tank can be installed flush with floor. No pit required for pump. Low and medium pressure units equipped with single stage pumps of vertical design. For higher pressure units a multistage pump of special design is used. Capacity in sq.ft. direct C.I. radiation or equivalent 2000 to 50,000. Single and duplex units.

Type S—Condensation Pump with Steel Receiver—An "Economy" installation where service is not severe and heavy construction cast iron tanks are not required. Where steel receiver is satisfactory and low cost is of primary importance Type S is recommended. However, these low cost models are the equal of the top grade in many competitive lines. Single or duplex units.

Type MR—Lightweight Pump for low pressure steam heating systems. Priced to meet competition . . . with no compromise in workmanship and materials. Capacities up to 65,000 sq.ft. E.D.R. Single and Duplex Units.

Types B and C—Horizontal Return Condensation Pumps—Type B multi-stage pump for pressures up to 150 lbs. 1750 RPM. Quiet operation. Capacities in sq.ft. direct C.I. radiation equivalent to 6000 to 65,000.

Type C multi-stage pump for pressures up to 175 lbs. 3600 RPM 60 cycle. Identical to type B except for higher speed operation. Capacities in sq.ft. direct C.I. radiation equivalent to 6000 to 65,000.

Type G—Horizontal Return Condensation Pump—Type G single suction, single stage designed for medium and high pressures at motor speeds 1800 to 3450 RPM. Receivers of all three types, "B", "C" and "G" are welded steel plate unless otherwise ordered.

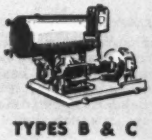
All Wheeler-Economy Heating Pumps are tested before shipment and guaranteed for workmanship and materials.

TYPES E & EC

TYPE U

TYPE S

TYPE MR



TYPES B & C

TYPE G

SOME TERRITORIES STILL AVAILABLE FOR REPRESENTATIVES WHO QUALIFY

Over 15 million dollars' worth of these pumps are in use throughout the United States

126

WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. · DIVISION OF C. H. WHEELER MANUFACTURING CO.

19TH AND LEHIGH, PHILADELPHIA 32, PA.

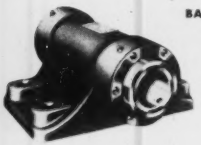
WHEREVER QUIET IS REQUIRED

SLEEVOIL PILLOW BLOCK
A precision-built, ring-oiling babbitted bearing, self aligning and exceptionally quiet in operation.

WATER-COOLED SLEEVOIL
Sleevoil Pillow Block, designed for industrial applications where high temperatures are encountered.

DODGE BRONZOIL
Capillary bronze bushing has capacity of one-third its volume in oil. Reservoir with close fitting wick around bushing provides ample lubrication. Both pillow blocks and flange units.

BRONZE BUSHED PILLOW BLOCK
Designed for arrangement No. 2 installations. Two bronze bushings of high lead content mounted in one cast iron housing. Special T-section rings for dependable lubrication.



BALL BEARING PILLOW BLOCK
For anti-friction installations. Two single row, deep groove ball bearings in one cast iron housing. Extended inner races carry the shaft.

CALL THE TRANSMISSIONEER
your local Dodge Distributor, for information about the entire Dodge line of bearings for fan and blower service. Look for his name in the Classified Telephone Directory under "Power Transmission Equipment," or write to the factory.

DODGE BEARINGS
FOR FAN AND BLOWER SERVICE

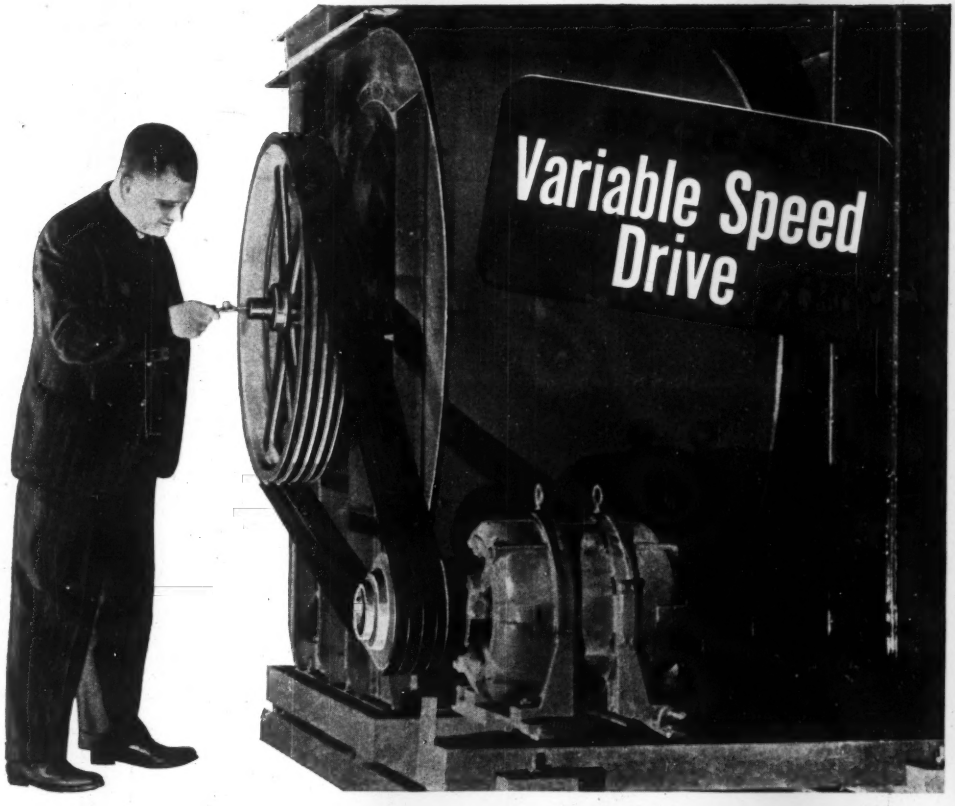
FOR INSTALLATIONS in hospitals, auditoriums, office buildings — wherever quiet operation is essential, Dodge offers the perfect answer to the bearing problem. Dodge manufactures a *complete line* of bearings for fan and blower service, all engineered and precision-built for exceptional quietness in operation.

The Dodge line has been developed in close cooperation with the manufacturers of fan and blower equipment, to meet the specialized requirements in this field, efficiently and economically. For complete information on Dodge fan and blower bearings see your Dodge Distributor—or write the factory.

DODGE MANUFACTURING CORPORATION
1600 UNION STREET, MISHAWAKA, INDIANA

DODGE
of Mishawaka, Ind.

NAME PLATES
FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS



Get DOUBLE Advantage

. . . USING VARI-PITCH SHEAVES ON FAN DRIVES

THE TIME-SAVING feature of *Vari-Pitch* drives is *doubly* important:

☛ First, equipment makers save time! It's only necessary to make estimates of fan speed requirements at the factory. Later, exact air flow can be set on the job by simple adjustment of *Vari-Pitch* sheave. This means a minimum of pre-engineering.

☛ Next, the contractor saves time. It's easier to balance the system when *Vari-Pitch* sheaves are used instead of fixed diameter sheaves. Changes in air flow provided without dismantling drive by simple change of pitch diameter of sheave.

In addition, the ultimate user saves time too. Seasonal adjustments in air flow are quick and easy.

Find out how easy it is to use *Vari-Pitch* sheaves on your V-belt drives. Call your nearby Allis-Chalmers distributor or district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3737

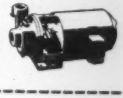
Texrope and Vari-Pitch are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

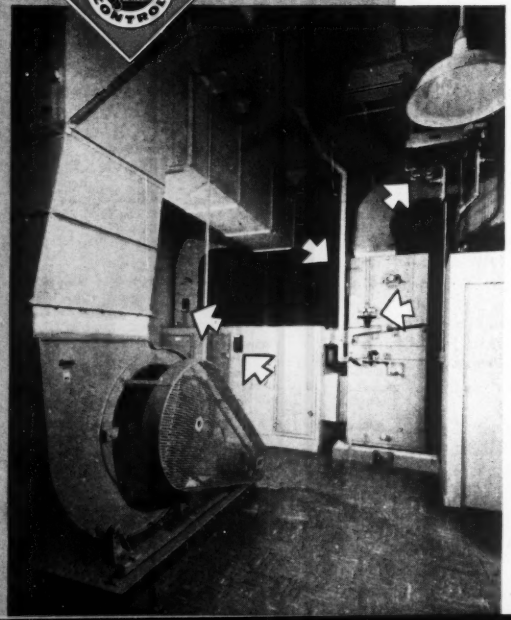


PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

POWERS for Heating and

PNEUMATIC CONTROL SYSTEMS

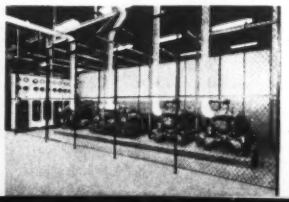


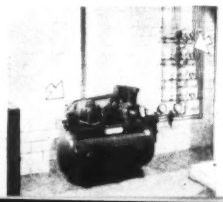
POWERS Design for MODERN CONTROL PANEL

In the unique functional design of this Control Panel are integrated various types of POWERS pneumatic controlling, indicating and recording instruments. It masterminds the operation of four complete year round air conditioning systems in the modern plant shown on the next page.

Photos at left and top and bottom of next page show air conditioning systems regulated by the Control Panel. Arrows indicate Powers controls.

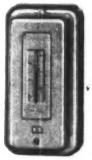
Photo below, left—shows four refrigerator compressors, one for each air conditioning system; photo right—Powers air compressor and pilot valves supplying air pressure for control system.





Air Conditioning

Assure Superior Performance at Lowest Cost for Operation and Maintenance



Room Thermostat for Offices

POWERS TEMPERATURE and HUMIDITY CONTROL SYSTEMS

prevent OVER-heated air in offices, factories, process rooms and other spaces. Comfortable, healthful room temperature

★ **Increases Output of Workers**—Over-heated air hastens fatigue, causes mistakes, accidents, increases colds, absenteeism and reduces production.

★ **Cuts Heating Costs up to 25%**—Keeping each room at its proper temperature prevents waste of fuel from OVER-heating.

Constant Temperature and Humidity conditions in each room can be maintained at any predetermined point with Powers control. It can be installed in existing as well as new buildings.

25 to 40 Years of Dependable Service with very low maintenance cost is reported by hundreds of users. Powers control is notable for its continuous accurate performance.

Precision Control for Processes—Wherever product uniformity and quality are dependent upon precise temperature and humidity regulation, use Powers controlling, indicating or recording instruments.

New modern plant commemorating 60th anniversary of The Powers Regulator Co., pioneer in pneumatic operated controls for heating, air conditioning systems and industrial processes.

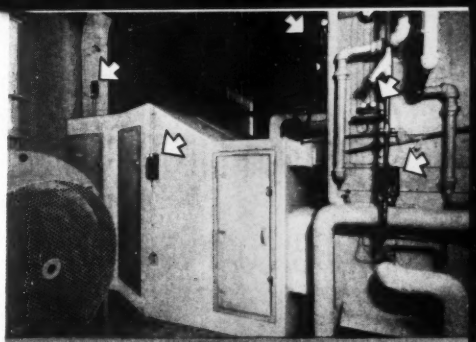
Phone or write our nearest office for help in selecting the type of automatic control that will give best results for your requirements. There's no obligation.

THE POWERS REGULATOR CO.

Established 1891 • SKOKIE, ILLINOIS • Offices in Over 50 Cities

CHICAGO 13, ILL., 3819 N. Ashland Ave. • NEW YORK 17, N. Y., 231 E. 46 St.
LOS ANGELES 5, CAL., 1808 W. 8th St. • BOSTON 15, MASS., 125 St. Botolph St.
DETROIT 1, MICH., 2631 Woodward Ave. • TORONTO, ONT., 195 Spadina Ave.
PHILADELPHIA 32, PA., 2240 N. Broad St.

(a83b)



POWERS

Above: Arrows indicate some of the many controls applied to air conditioning systems. Powers Duct Hygrostat, Duct Thermostat, Pneumatic Switch, Diaphragm Valves and Damper Motors, Static Pressure Regulators, etc.

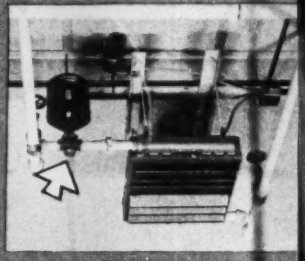
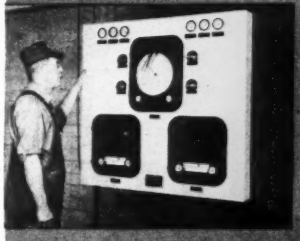
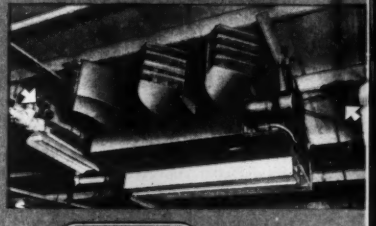


Photo at right shows ceiling type unit heater used in factory. It is controlled by wall type thermostat which also regulates Vulcan fin type radiation below windows.

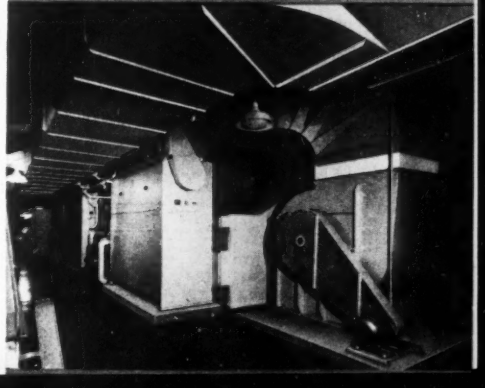


Left: Instrument panel for Powers MASTROL System of forced hot water temperature control for heating.

Below: Factory fresh air ventilating units heat and filter outdoor air providing two air changes per hour in winter and ten in summer.



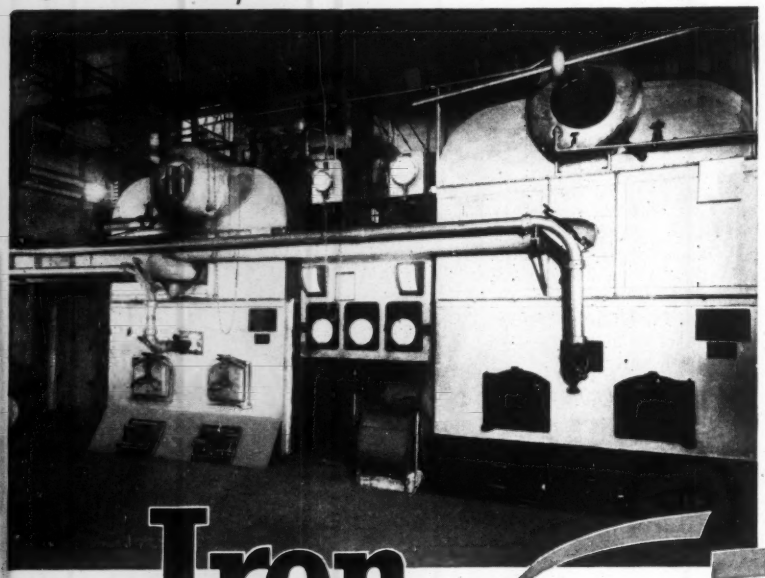
POWERS



"Our Iron Fireman stokers burn lowest grade coal yet deliver top efficiency"

Says Mr. Wm. F. DeWolfe, Chief Engineer, St. Joseph's Hospital, Saint John, N. B.

"Our steam demand varies from 50% to 150% of boiler rating and we are very well pleased with the flexibility and over-all performance of our Iron Fireman stokers. We are burning Minto coal, the lowest grade coal in this area, yet the monthly average efficiency has been as high as 81% at an average monthly rating of 82% of capacity. At summer loads with boiler rating down to 30% and lower we can still get 65% efficiency."



Iron Fireman Pneumatic Spreader stokers in the St. Joseph's Hospital boiler room. Coal is dried, pre-heated pneumatically conveyed and distributed over the entire fuel bed.

Iron Fireman

PNEUMATIC SPREADER STOKERS

The Iron Fireman Pneumatic Spreader stoker is a coal-drying, coal conveying, and highly efficient combustion system, all in one money-saving package. It burns a wide range of coals, including low-ash fusion, sub-bituminous and lignite—ranging from ¼" slack to 2" top size. The fuel is dried and conveyed by hot furnace gases directly from main bunker to fire. Readily adaptable to any boiler room layout. Capacities available to 1,000 boiler horsepower in single units; multiple units for larger capacities. Find out how much an Iron Fireman can save for YOU. Phone your nearest dealer or send coupon for descriptive literature.

MAIL COUPON FOR LITERATURE

IRON FIREMAN MANUFACTURING CO.
5273 West 106th Street, Cleveland 11, Ohio.

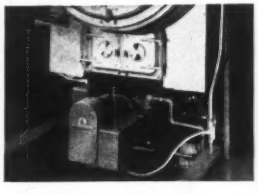
Please send literature as checked:

☐ Pneumatic Spreader Stoker ☐ Coal-Flow Stoker
☐ Commercial Gas Burner ☐ Rotary Oil Burner

Name_____

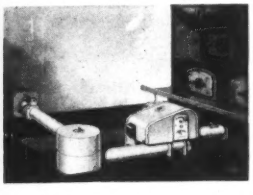
Address_____

City_____ State_____



Iron Fireman Rotary Oil Burner

Fires low-cost, heat-rich heavy oils (5 & 6) with complete uniformity regardless of viscosity. A real money-saver. Capacities to 500 boiler horsepower.

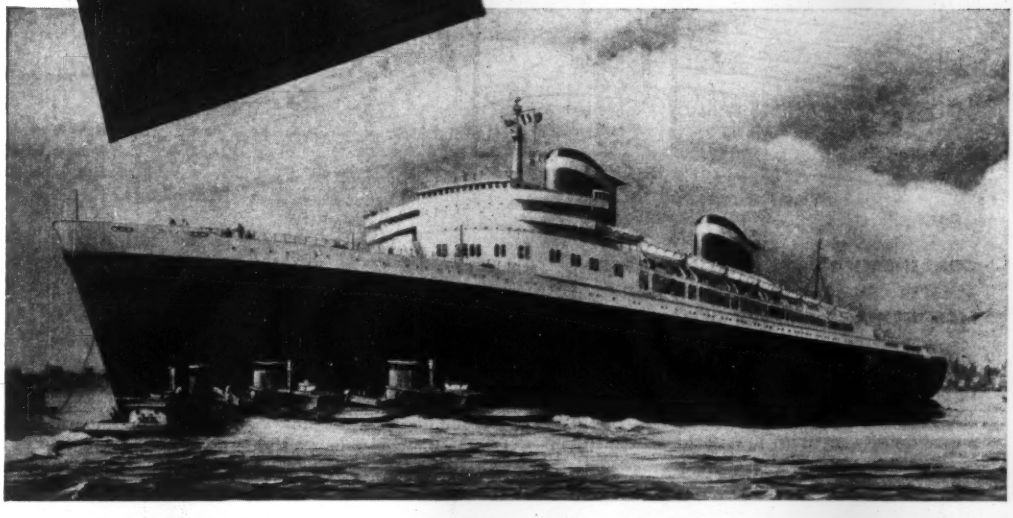


Iron Fireman Coal-Flow Stoker

Feeds coal direct from bin. No coal handling. Coal and air automatically adjusted to boiler load at all times. Capacities to 500 boiler horsepower.

AUTOMATIC FIRING FOR HOMES, BUILDINGS, INDUSTRIAL PLANTS

THE *Traditional* MARITIME METAL



Since the earliest days of the Viking ships, copper and copper base alloys have been a traditional and vital metal in all ship construction to withstand the highly corrosive conditions of the sea. Today more than ever, copper is used extensively throughout giant ocean liners like the new S.S. UNITED STATES—51,500 ton luxury ship of the United States Lines. This new ship is the largest fully air conditioned ship in the world—and copper, of course, played an important role in her vast air conditioning system.

Wherever the long life and dependability of copper are required you'll find HUSSEY Copper well represented.

HUSSEY COPPER *and Brass*

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
ROLLING MILLS AND GENERAL OFFICES
PITTSBURGH 19, PA.

7 Convenient Warehouses to serve you:

PITTSBURGH (19)
2850 Second Avenue

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NEW YORK (13)
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CHICAGO (18)
3900 N. Elston Avenue

ST. LOUIS (3)
1620 Delmar Boulevard

PHILADELPHIA (30)
1632 Fairmount Avenue

CINCINNATI (2)
424 Commercial Square

More Destructive than Termites!

CONDENSATION WILL MAKE PAINT PEEL, PLASTER CRUMBLE, WOOD ROT, AND MASONRY AND MORTAR DETERIORATE.

Ordinary insulation in walls lets water vapor flow through, condense, accumulate and cause damage. Vapor is a gas. It flows through walls from high vapor density areas to low. Cold air can retain less vapor in suspension, and creates a low density area. Vapor pierces plaster, wood, brick, stone, asphalt, building paper, ordinary insulations. Wherever it touches a substance colder than its dew-point, it condenses.

Inside walls, within ordinary insulation, onto and within siding or sheathing, onto inner wall surfaces, vapor flows and condenses if a vapor barrier of **zero** permeability is not provided. Upon condensing, it stimulates fungi and insects which greedily break down wood and cause timber rot. It makes paint peel, plaster crumble, iron rust.

Impervious to vapor, multiple accordion aluminum is also non-condensation-forming. The slight mass of the aluminum sheet on the warm side (1/5 oz. per sq. ft.) approximates the adjacent air's temperature (by conduction) so quickly that it can extract very little heat from it. Therefore the air can retain its vapor content in suspension, without otherwise resulting condensation.

Each aluminum sheet throws back 97% radiation on the warm side, emits but 3% on the cold. On the cold side, each aluminum sheet is slightly warmer than adjacent air, and heats it. Therefore the capacity of the air to retain vapor in suspension is slightly increased, and no dewpoint is ever reached. Nowhere on nor within multiple accordion aluminum does condensation formation occur.

The aluminum and fiber sheets block inner and outer convection. In addition, the air spaces practically eliminate conduction.

Multiple accordion aluminum is commercially available as Infra Insulation, Types 6, 4, and 4 Jr. For a complete discussion of the subject, ask us to send at our expense, Schwartz's "Simplified Physics of Vapor and Thermal Insulation," and the Government booklet, "Insulation and Weather-Proofing" (Div. Farm Bldgs. & Rural Housing).

INFRA WALL HEAT FLOW THERMAL FACTORS

Type 6	C.073, R 13.69 = 5⅝" dry Rockwool
Type 4	C.107, R 9.34 = 3¾" dry Rockwool
Type 4 Jr.	C.123, R 8.13 = 3⅓" dry Rockwool (Type 4 Jr. in 1" Space)

INFRA INSULATION, INC.
525 Broadway, New York, N. Y.
WOrth 4-2241

Infra Insulation, Inc., 525 Bway., N.Y.C. Dept. H6
( ) Please send free literature on how to avoid damage by condensation.
( ) Send price lists ( ) Send free sample
Name_____
Address_____

THE EDITOR'S PAGES

THE PROBLEMS OF air pollution control and smoke abatement can be quite involved, as was evidenced by an incident we observed last month. One of those official business cars — the "private" railroad cars with the brass-railed "back porch" — was parked in the downtown station to and from which we commute daily. It stood there for several evenings — as we ran for our suburban train — pouring thick black smoke from its cookstove stack all over the station and the commuters. What bothered us even more than the smoke was the thought that that railroad has undoubtedly spent a lot of money on smoke control activities — which hasn't done much good when that particular car is standing in one of its principal stations. . . . . By coincidence, another item we'd like to mention this month also has to do with cookery. A cafeteria at a new industrial plant — a beautifully decorated and clean establishment serving excellent food at very low prices (as the company subsidizes it rather heavily) — wasn't being patronized by the employees as much as seemed logical, and the management of the firm made some inquiries. The principal explanation given (so help us) was that the food tasted so much like home-cooking that many of the office girls preferred to go out for lunch so they'd have a change. No plans are being made to lower the quality of the food or its preparation — although this would no doubt result in an increase in patronage.

WHY CATS HAVE KITTENS

HEATING, PIPING & Air Conditioning "made" the column, *Here and There in Berrien*, in the St. Joseph, Mich., newspaper the other day when the pet cat at the Skidmore Corp. apparently saw the artist's drawing for Skidmore's advertisement which ran in last month's HPAC and promptly gave birth to the right number of kittens.

The ad showed a cat and three kittens and was headlined "We have quite a following too —". Ted Shierk, who made the drawing, is pleased not only with the "reader response" to the advertisement, but is happy about the "cat response" as well.

If you have a cat and you want the cat to have kittens, this would seem to prove that the best thing to do is to prepare an advertisement for publication in HPAC.

ROYAL MUSKOKA HOTEL DESTROYED BY FIRE

THE ROYAL MUSKOKA hotel — scene of the American Society of Heating and Ventilating Engineers semi-annual meeting in June 1950 — was destroyed by fire last month. The 70-room building had not yet been opened for the summer season and no one was injured, according to press reports.

NEW TV STATIONS OPEN BIG AIR CONDITIONING FIELD

LIFTING OF THE FCC freeze on new television stations opens up another broad new field where air conditioning is a virtual "must," according to Lawrence K. Macrow, director of application engineering for Carrier Corp.

The ban's end is expected to raise the number of TV outlets in the nation from 170 to approximately 2000, extending video coverage from 63 cities to 1200 communities across the country.

Mr. Macrow compared the new market to the textile and tobacco industries, where for many years air conditioning has been considered essential.

"In contrast to those industries," he said, "where humidity was the first consideration, the over-riding problem in television studios is heat itself. The tremendous heat load generated by the lights in a studio completely closed in by elaborate soundproofing systems can't possibly be handled without modern air conditioning."

One disastrous result, he pointed out, could be the effect of perspiration generated by the heat on the heavy make-up necessary for television actors.

Carrier has made a special study of TV studio problems, he said. During the first television studio boom until the ban was laid down in 1948, the company was involved in the air conditioning of many stations throughout the country.

CONFER ON USES OF ANTHRACITE

THE USE OF HIGH temperature for drying alfalfa to retain protein and vitamin content and green color was explained to more than 200 delegates attending last month's 10th annual Anthracite Conference at Lehigh University. Charles Sanford, of the Illinois Stoker Co., described an experiment conducted by the Schoeneck Farms, Macungie, Pa. in alfalfa drying with barley anthracite coal.

The drying equipment consists of an automatic feeding device to give uniform flow of material into the dryer drum; a furnace equipped with an automatic stoker and controls to regulate the heat in the dryer; the dryer drum with circulating fan and collector cyclone, a high speed hammer mill to convert the hay into meal, and a cooling drum to reduce the temperature of the meal to about 80 deg.

The alfalfa is not allowed to lie in the sun any length of time. After it is mowed, it is picked up, chopped and loaded into trucks immediately, to prevent the sun from destroying any of its vitamin content or bleaching its color. It takes the alfalfa from 4 to 5 min to pass through the dryer and in this period of time the moisture content is reduced from 70 to 8 percent. This is known as flash drying. Because of the way the alfalfa is harvested and the speed with which it is dried, the vitamin content is at its highest, and the color remains green, he said.

In order to preserve the color and vitamin content of the meal after it has been dried and ground, it is cooled before bagging. This operation permits it to be carried a longer time in storage without losing too much of its vitamin content.

George B. Applin, administrative assistant, Hudson Coal Co., told the conference that "price is not the final and determining factor in the selection of fuels."

In reporting on recent experimental results on the effect of sulfur dioxide on the curing of tobacco, J. A. Weybrew, of the North Carolina Agricultural Experiment Station, said:

"Tobaccos that had been exposed to sulfur dioxide during late yellowing subsequently dried out slightly more rapidly than did unexposed tobacco. When these same tobaccos were ordered under controlled conditions, the exposed tobacco took up moisture much more slowly than did the normal tobacco."

Walter P. Bloecher, president of the Berks Building Block Co., said that improved automatic machinery and manufacturing technology have resulted in improved building blocks at prices that have shown only a small increase during the past decade. Anthracite cinders are superior for block making, he said.

The need for research by the anthracite industry to develop equipment for new housing was cited by Dr. Raymond C. Johnson, vice president of the Anthracite Institute.

Charles J. Farrell, design engineer, Valencia, Pa., described a newly developed low-cost installation method for hot water and steam heating as designed for the 164 family Scranton Housing Authority project. He explained the design for a four-family unit on the new "heat bank" theory of storage of heat in inside partitions instead of blanketing the cold outside wall.

"The resulting lower operating temperatures due to combination of recovery of normal reverse loads to cold outside walls, plus storage of heat in both sides of partition walls being radiated to occupants," he said, "creates comfort conditions without overheating the warmer partition wall."

He pointed out that this system will not favor condensation of water vapor from room air, thus improving humidity conditions, and "at the same time, it lessens the possibility of deposit of dirt. Outer walls are also made available for furniture arrangement or long draperies."

A system of automatic ash disposal which supplements existing burner equipment was discussed by Neil H. Gebhardt, president of the Gebhardt Coal and Coke Co., Erie, Pa. Development of a closed vacuum system, described by Mr. Gebhardt, eliminates dust in the basement and in the driveway. A streamlined truck on which is mounted a large vacuum tank and a fan powered by the truck motor has been developed to convey mechanically ashes from the installation. "A light, flexible hose carried on the truck is connected to basement tube terminals," he said, "and vacuum is used to pull the ash from the basement receptacle into an air stream and then it is deposited in the truck mounted vacuum tank."

R. H. Hampton, Beaumont Birch Co., Philadelphia, described various methods of ash handling in commercial and small industrial stokers.

"In order to compete with other fuels," he said, "it will take complete cooperation between coal producers, dealers, equipment manufacturers, consulting engineers and personnel of the plant who select and operate the equipment.

"From the coal and ash handling standpoint, the dealers could provide facilities for cleaning, storing, sizing and possibly drying coal. Consulting engineers and architects could work out boiler locations and building designs in keeping with limitations of equipment available for the cost justified by plant size."

Dr. Calvin Wright, chief of the division of fuel technology, Pennsylvania State College, reported on findings in tests of activated carbon from anthracite. He said that research suggests "certain adsorptive powers of activated anthracite may be improved by more detailed study of activation conditions and processing."

R. F. Loomis, chief engineer of the Hershey Machine and Foundry Co., discussed the design and performance characteristics of a newly developed commercial crossfeed stoker. J. J. Hassett, Jr., president, Elmira Coal Co., Elmira, N.Y., explained the performance, design and installation of a new commercial conversion stoker.

SETS EXAMPLE IN AIR PURIFICATION

RACINE, WIS., has set an example for cooperative effort in air purification which could be copied with much profit by many communities throughout the country, according to the Coal Producers Committee for Smoke Abatement.

In February 1950, the committee — at the request of interested parties and Dr. Albert C. Edwards, commissioner of health — surveyed 52 plants in Racine. These plants were selected by the local committee as being among the worst offenders from a smoke and fly ash standpoint.

After the survey was completed and the report, together with recommendations for corrections in the individual plants, had been presented to a civic committee headed by Dr. Edwards, it was decided to proceed on a voluntary basis rather than to ask the city council to pass a control ordinance.

In February 1952, the committee made a reappraisal of the situation. Thirty-two of the 52 plants had followed the recommendations for correcting smoke, either wholly or in part. The number improperly operated had been cut from 30 to 15, and not a single plant was found to be overloaded.

Summarizing its findings, the committee says that "effective smoke abatement is being accomplished without public expense, additional regulations or actions in court. Less trash and refuse is being burned; housekeeping in most plants is good."

NEEDS A MECHANICAL ENGINEER

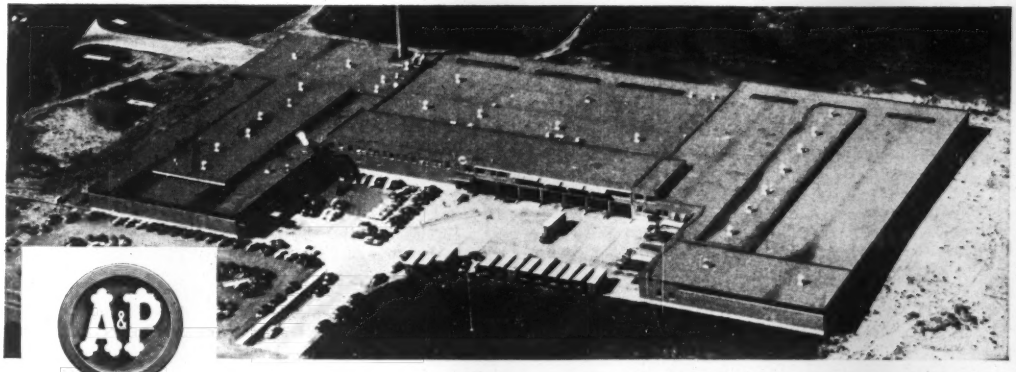
ACCORDING TO A notice received last month, the New York District, Corps of Engineers, U. S. Army, 80 Lafayette St., New York 13, "has an urgent need" for a mechanical engineer for heating, air conditioning and refrigeration work. Interested applicants may obtain further information from the Personnel Branch at that address.

AEC SETS UP INDUSTRIAL HYGIENE TRAINING PROGRAM

THE ATOMIC ENERGY Commission has inaugurated a one-year fellowship training program for industrial hygienists, starting this fall. If qualified candidates can be obtained, up to four will be selected for one school year of academic training.

Applicants must have a degree in engineering, chemistry or physics. Application blanks may be obtained from Merril Eisenbud, New York Operations Office, U.S. Atomic Energy Commission, P.O. Box 30, Ansonia Sta., New York 23, N. Y.

COMING NEXT MONTH — An article describing the details of the new air conditioning installation for the building in which the national political conventions will be held will appear in the July HPAC.



Great Atlantic & Pacific Tea Company Warehouse, Albany, N. Y. Heating Contractor: E. W. Tompkins Company, Inc.

WAREHOUSE

Heated by:

- Webster Moderator System of Steam Heating
- Webster-Nesbitt Unit Heaters—Propeller-Fan, Giant, Down-Blow
- Webster Walvector along exposed walls
- Webster Drip Traps and Double-Service Valves
- Nash Vacuum Heating Pumps

Meeting

WAREHOUSE HEATING

Requirements

There are three basic requirements for effective warehouse heating and Webster Steam Heating Equipment meets all three:

(1) Economy . . . You can cut steam consumption by using less heat in mild weather, full heat only when the outdoor temperature falls. A Webster Moderator System does just that—cuts heating costs $1,100 per year for a large Philadelphia warehouse, reduces steam consumption 17% for a mercantile warehouse in Baltimore.

(2) Heat where you want it . . . You can spot heat where you want it and assure plenty of circulating air with Webster-Nesbitt Unit Heaters—Propeller-Fan, Giant, Down-Blow. Or you can spread heat all around the perimeter of the building with Webster Walvector® Radiation.

(3) Maintenance-free operation . . . You can depend on Webster Equipment—traps, valves, radiation, controls—for long dependable service. All are products of one manufacturer under undivided responsibility. Rugged construction is ideal for warehouse service.

Webster's record of successful warehouse heating is due in part to an experienced field organization serving architects, engineers and heating contractors. If you are planning a new warehouse or modernization of the heating in an existing warehouse, call the nearest Webster factory representative or write us for his name.

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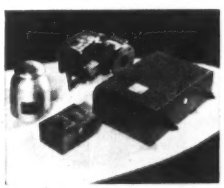
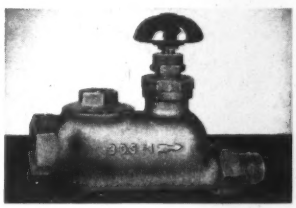
Webster HEATING

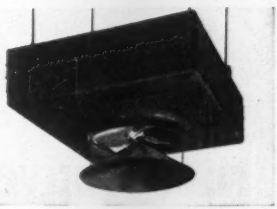


These four components plus orifices provide Webster Moderator Control.



Webster Double Service Valve meets warehouse requirements by combining drip of down-feed riser and supply valve to Webster Walvector®. Replaces trap and valve, saves six or more items of pipe and fittings.

Webster Float and Thermostatic Drip Trap, the standard for Unit Heaters with low-pressure steam.

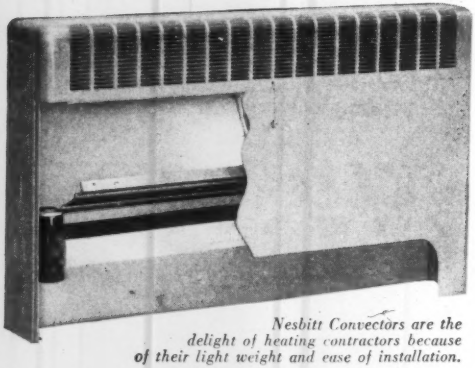


Webster-Nesbitt Little Giant Down-Blow Unit Heater with cone distributor. Located near ceiling out of the way provides effective heat distribution for any desired temperature in area served.

How many of these *advantages* do you get in the *convectors* YOU buy?

Model U Convectors provide clean, uniform heat as well as comfortable radiation.

You get all these in NESBITT Model U Convectors



Nesbitt Convectors are the delight of heating contractors because of their light weight and ease of installation.

Scientific design: an *engineered* product resulting from 40 years of Nesbitt *pionairing* in the comfort heating field. ☐

Superior construction: of heavier than customary furniture steel; sturdily reinforced; built up to a reputation, not down to a price. ☐

Artistic styling: conformable to the best décor; rounded edges; functional curved-top grille for added heating capacity. ☐

Pleasing finish: phosphated metal, hardcoated in a neutral prime gray that takes a color coat well, but does not require it. ☐

Universal application: to one or two-pipe hot water systems (forced or gravity), or to two-pipe steam systems. ☐

Optional placement: the one casing may be installed free-standing or semi-recessed, as desired, with front easily removable. ☐

Easy connection: with universal headers tapped for every practicable hookup without removal of element from casing. ☐

Stock sizes: modular lengths in two heights, offering 23 standard sizes—from wholesaler stock—for practically every requirement. ☐

Honest ratings: in generous conformance with Commercial Standard 140-47 and approved by the Convector Rating Committee. ☐

Individual packing: fully assembled in a durable corrugated carton for delivery to the job in mint condition. ☐

Dampers optional: in complete separate packages, with all attachments, for easy installation, originally or later. ☐

Competitive prices: with the savings of large-volume, production-line manufacture passed on to you. ☐

Reliable guarantee: against original defects in material or workmanship, for one year from date of shipment. ☐

Order Convectors *by name:* NESBITT

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"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

MAKING COST ANALYSIS OF HEATING OPERATION

FOLLOWING PRESENTATION at the American Power Conference and publication in the April HPAC of the paper on how to make a cost analysis of a central heating plant's operation, some comments have been received that criticize parts of the method described. It does not seem to me that the method should be "defended", particularly as it accomplishes the stated purposes very adequately at the Illinois Institute of Technology.

One such criticism apparently is that the method does not accomplish *more* than the stated purposes — i.e., that it does not tell the operating engineer *how* to operate his system for maximum efficiency, but only tells him on the basis of his own criteria whether he *is* or is *not* operating economically.

I do not believe that it is the function of an accounting system to tell the operating engineer that he should run a lower stack temperature or use more primary air. What the accounting system should and *does* do is to set a goal of good operation on a dollar basis and make it rather obvious to people who are not engineers whether or not this responsibility is being fulfilled.

As to the question brought up also of reviewing operation daily rather than monthly, I have the following remarks. Many variables of operation, such as overall efficiency, condensate return temperatures, fuel condition and so on, can and should be reviewed daily. Others, however, including line losses and building consumption, *cannot*, for two reasons. The first of these is that meters cannot be read daily in each of the buildings to which steam is supplied at a low enough expense for the operator to realize a profit from steam savings. Secondly, specific buildings do *not* consume steam in proportion to the number of degree days occurring during one day (i.e., the linearity between degree days and steam consumption holds only for extended periods).

These two variables, which are difficult for the operator to check on a day by day (or even week by week) basis, are "built in" to the monthly accounting system. The items that can be checked daily *are* checked daily — or rather, are checked during each 8 hr shift at our plant. We were not discussing operation, primarily, in the article and I saw no need to go into specific details of operation.

As to a comment pertaining to efficiency, I am sure that persons familiar with the operation of pulverized fuel fired boilers will agree that the efficiency stated is not unusual. I checked after receiving this comment and found that we had maintained 83.8 percent (slide rule calculation) during the previous three 8 hr shifts. This is the overall plant efficiency, but does not include the electric energy required to run some of the plant auxiliaries. The weather was rather mild on that day, so we do not feel that 83.8 was unusually high.

One's critics are, of course, most interesting people with whom to discuss the solution of problems. For this reason I would like to extend an invitation to visit our plant and discuss the problems of operation and accounting which are common to such installations.

Please let me encourage you to publish such comments on our article so that we can answer them specifically. I feel that the questions brought up were reasonable and can be answered adequately. — L. C. HARDISON, Mechanical Engineer, Illinois Institute of Technology.

NOISE TRANSMISSION IN PIPE LINES

THE PROBLEM OF water hammer, pump and machinery noise transmitting through air conditioning piping is in many cases a very critical one, and the author's point in the article on this subject in the March HPAC is well taken. This writer has seen several apartment houses in which the owner simply could not rent certain apartments while air conditioning equipment was in operation, due entirely to pipe line noise.

In most cases, pipe line noise can be eliminated at the time of initial installation far more economically than after complaints have arisen. This is particularly true in the case of completely welded pipe connections.

The author's analytical treatment of the problem seems quite comprehensive, except that the wave propagation along the complex medium of a water filled pipe is very seldom as simple as is described in the article, particularly in the case where the wave length of transmitted sound is of the same order of magnitude as the dimensions of the pipe. — RICHARD D. LEMMERMAN, Vice President, Industrial Sound Control, Inc.

HOW SHALL ENGINEERS BE TRAINED?

THANK YOU FOR calling to my attention the remarks of L. King of England [pages 71 and 72, May HPAC] on the question of training engineers. Below are my comments.

Based on the English system, I think his points are well taken. They

"QUOTE"

"Select the most advantageous hotel or hotels and *inquire about air conditioning*. Usually it is desirable to have company headquarters at the hotel that is convention headquarters. But at times there are advantages in having company personnel at some other nearby hotel.

"Arrange for generous supply of extra towels and soap in bathroom, extra folding chairs, electric fans *if air conditioning is not available*, etc." — *from an article of advice to industrial exhibitors, by Clarence W. Hamilton of the Sheffield Corp., published in the magazine Printers' Ink* [*italics added.*]

"QUOTE"

"There is a very real need for expanding America's sales plant to match the expanding physical plant . . . . . We must gear our selling machinery to the expansion of our production machinery if we are going to keep our factories running, our employment at a high level, and our economy healthy.

"The nation is going to have production capacity which, if properly directed and utilized, can raise material living standards beyond our fondest dreams.

"This important fact places upon management a responsibility which we have to understand more clearly and which will require more intelligent planning than we have ever given to this phase of our business before." — *J. M. McKibbin, Vice President, Westinghouse Electric Corp., in a recent talk.*

do not apply to the usual cooperative course plans here in the United States.

I well recall the confusion that existed at the beginning of the last war because of a lack of mutual understanding of the terms expressing degrees of training in the United States and in England. At first, where technical personnel were exchanged between the countries, the exchange was often made, unfortunately, at quite different levels — i.e., technicians for physicists. It was similar to the complete reverse in meaning in the two countries of the terms "public" and "private" as applying to secondary schools.

The cooperative courses to which I referred in my talk before the Engineers Council for Professional Development subtract nothing from the standard collegiate courses. They simply require extra time. The standard classroom time of 30 weeks per year is usually supplemented by 18 weeks of plant training. One very successful cooperative course cuts its ordinary class time to 20 weeks per year in the third and fourth years, but makes up for the lost 10 weeks in these years by adding a fifth year of 20 classroom weeks. Plant training of an apprenticeship nature is substituted for the shortened annual classroom time. In brief, all of the cooperative systems referred to add to the student's training and do not simply substitute one type for another.

One point made by Mr. King deserves emphasis — namely, that best results are obtained when a student takes all of his training with a single company. That is the usual practice in the United States. It is also an aid to the employer. It gives him an opportunity to watch for students having the characteristics he may be looking for. The company with which I am associated has hired many men from our cooperative student group, and because of this opportunity to study the men before they are hired, separations after hiring are almost unknown. — H. B. RICHMOND, Chairman of the Board, General Radio Co.

NOISE RATINGS FOR FANS

REPLYING TO R. A. GERLITZ'S recent comments on noise ratings of fans, in the March HPAC, I suggest reference to page 513 of Professor Sears' book *Principles of Physics — Part I* where will be found a curve by Dr. Fletcher showing the threshold of hearing at 25 cycles to be slightly above 65 db.

Evidently, Mr. Gerlitz's Fig. 2 was derived by measuring sound level intensity some distance away from the fan unit with a conventional sound level meter and by having the ear pick up the pulses wherever it could — making the whole thing worthless. It is improbable that an average ear will hear 56 db at 25 cycles; hence, it is assumed that the actual throb frequency was much greater than that shown on the curve.

The conventional sound level meter isn't much use for research work; hence, when one is accustomed to using sound level metering equipment, he is apt to use the phrase sound level meter synonymous with sound level metering equipment. The writer, therefore, deserves to be criticized for loose phraseology in the statement "peak pressures would show on the sound level meter". In the many hundreds of fans the writer has designed ranging from two to 18 blades, his ears have never detected a throb in fans having from five blades and up and therefore must maintain the statement that throbbing is limited to two and three bladed fans.

In fan sound level analysis, the most annoying frequency is usually the blade frequency (commonly referred to as the fundamental) and the second and third harmonics which, when used with the acoustic power output of the fan, enable the architect or engineer to compute his acoustical needs.

No statement was ever made about fan noise being composed of a discreet fundamental frequency plus harmonics. It would be helpful and interesting if other people would voice their views on this particular discussion.

The Industrial Unit Heater Association's committee for sound is still at work on the preparation of a sound code which should be ready within the next year for publication. The IUHA committee is studying the work of the National Noise Abatement Committee very closely and most likely will incorporate many ideas advanced by this committee in its code. — A. CURRIE, Chief Research Engineer, L. J. Wing Mfg. Co.

THRESHOLD LIMIT VALUES

ON PAGE 101 OF the December HPAC there appeared a Data Sheet under the title "Threshold Limit Values for 1951."

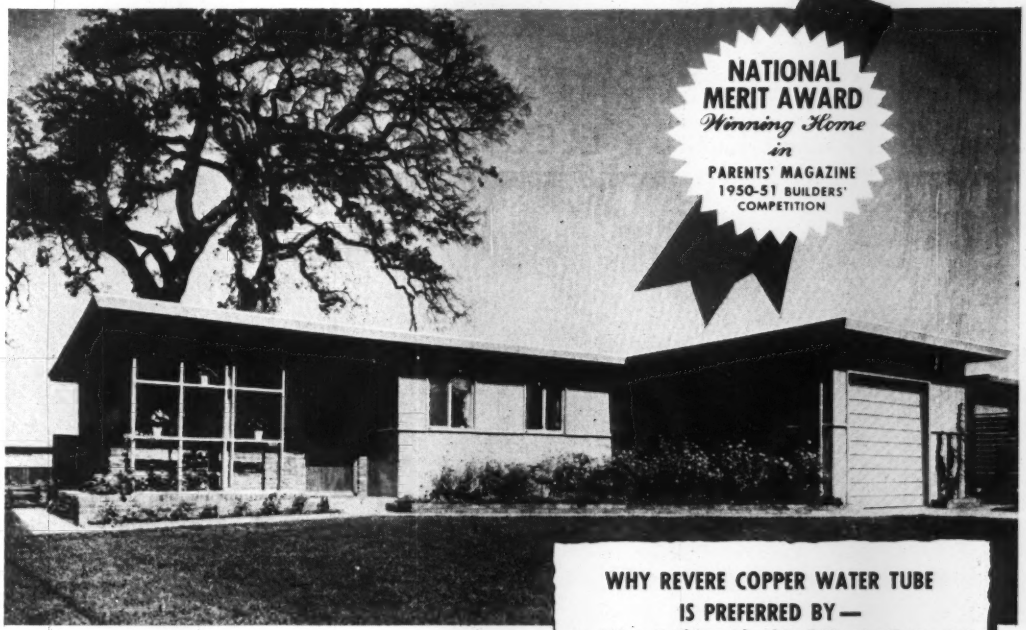
I could not find this term defined anywhere in the American Society of Heating and Ventilating Engineers' Guide. I checked with the local office of the Pennsylvania Department of Industrial Hygiene and was advised that they commonly use the term "maximum allowable limits" in the sense which is obviously meant here.

I think that the term "threshold limit values" is ambiguous enough to merit either definition or explanatory notes when it is used in such cases. This use of the word "threshold" is not the same as that understood in the study of odors.

I hope that all of this does not seem like carping criticism. I have written it merely because I feel sure that every effort is being made to make HPAC's offerings as easy to use as possible. On the whole, a fine job is done. — C. H. SAWYER, Research Engineer, Eastern Gas and Fuel Associates.

* * * *

DID YOU FIND these discussions of interest? Your own views on these and other matters would interest others. You are invited to contribute them.



ANOTHER CASE OF *Copper* WHERE IT COUNTS

Designers, architects, contractors and builders tell us that in many cases there simply is no adequate substitute for copper. As a result they are using what copper they can get where it counts most. One of those places is in hot and cold water lines in homes like the one shown. This installation required 90′ of ¾″ and 160′ of ½″ Revere Copper Water Tube, Type L. This National Award Winning Home was built by Jere Strizek. Designer was John W. Davis, both of Sacramento, Cal. There are more than 100 similar homes in the Town & Country area where this house was built. Plumbing contractor for 31 of the homes (all of which contain Revere Copper Water Tube) was Beckes & Anderson, Carmichael, Cal.

Next time you build, plan, specify or install, make sure Revere Copper is used in the spots where enduring performance counts most. The architects, builders and contractors who do have found it pays dividends in prestige, reputation and customer satisfaction.

See your Revere Distributor. He will advise you of the availability of materials and, in the event you wish to discuss your technical problems, put you in touch with Revere's Technical Advisory Service.

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WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

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Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand. Hard temper by hand bending tools.

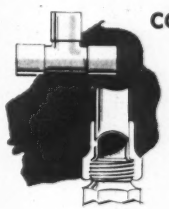
HANDY LENGTHS

Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20′ in hard and soft tempers. 60′ coils of soft temper reduce the number of fittings needed.

SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal



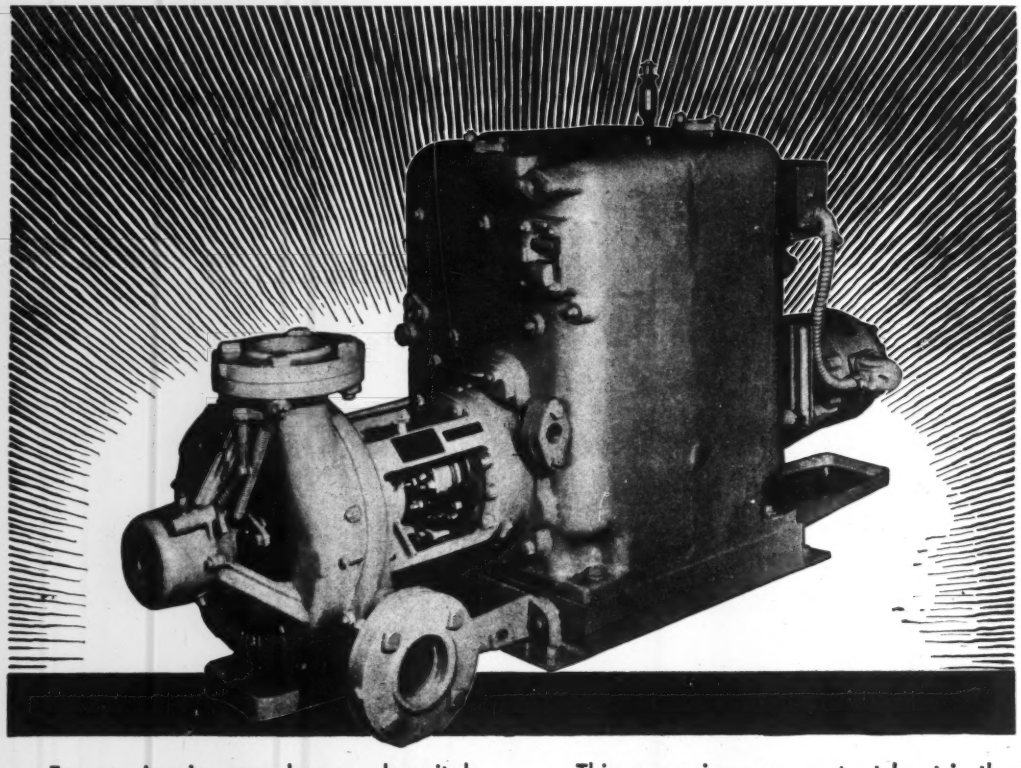
No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

Safety!

THE NASH VAPOR TURBINE HEATING PUMP IS NOT STOPPED BY ELECTRIC CURRENT FAILURE



For service in greenhouses, hospitals, schools, theatres, and public buildings, where heat failure is a serious matter, the Nash Vapor Turbine Return Line Vacuum Heating pump should be specified, for this pump operates perfectly without electric current.

This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the Vapor Turbine is returned to the system for heating, with little heat loss.

This pump insures constant heat in the system, it eliminates electric current cost, and it promotes high efficiency in the heating system. Heating efficiency is due to the fact that this pump can operate continuously with economy. Continuous operation means uniform circulation, and uniform conditions in the system mean steam saving.

This pump has but one moving part, no internal wearing parts, and requires no internal lubrication. Bulletin D-246 tells all about it, and it is free on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Unusual Fireboxes Solve Oil Burner Installations

KALMAN STEINER, of C. Hoffberger Co., and a member of HPAC's board of consulting and contributing editors, describes several cases where out-of-the-ordinary methods were required to make satisfactory oil burner installations. Such jobs add zest to the task and profit for engineers and contractors who probe below the surface to design, plan and install to best meet the particular conditions and the owner's needs, he says

HEATING ENGINEERS and contractors occasionally run into situations that call for out-of-the-ordinary methods for oil firing a boiler. These situations may arise because of peculiar local conditions — such as the nature of the ground or the design of the building structure — or because of the type of performance that the owner requires of the boiler. In such cases, a careful analysis of the factors that affect the problem, and a solution that may call for considerable ingenuity, are required.

Pitting Boilers Under Difficulties

A certain multi-story concrete apartment house had been erected many years ago with a rather low ceiling height in the basement, barely adequate for the setting of the two boilers. Good practice would have called for pitting the floor under the boilers, to provide additional clearance below the mud ring and to create the combustion volume considered as minimum for proper combustion. But to excavate pits posed problems that must then have been considered insoluble.

Naturally, the boiler operation was quite unsatisfactory. Lack of combustion space restricted the boiler output and created a marked tendency toward smoking, requiring careful supervision to avoid violation of the smoke code. The boilers supplied both heat and hot water, involving 12-month operation.

Fig. 1 illustrates the difficulties involved in excavating pits under these boilers. Building columns stand immediately alongside the outer walls on each side, and their footings extend under the boilers. Structural engineers who were consulted expressed the fear that it would not be safe to cut away any considerable portion of these footings.

Operating conditions became so intolerable that the management decided to investigate the possibilities of oil burning. To fire through the existing steel base clearance with oil would be as unsatisfactory as before. The same pitting problem confronted the oil burner installation, and existed whether oil firing were attempted from the front or from the rear. The decision was finally made to attempt offside firing, from the front.

The structural engineers approved a plan to chamfer off a corner of the footing from the edge that extended along the longitudinal axis of the boiler. The boiler base rested on the top surface of the footing, and the latter was about 30 in. deep. The pit itself was made 3 ft deep, or about 6 in. lower than the bottom of the footing. An 8 in. brick wall was erected to underpin the footing. The steel front plate stretched across the pit, at the boiler front in the usual way, but was set with a slight angle to shift the burner axis to the left of the boiler axis, in the case of the right hand boiler, and opposite in the other boiler. The burners were mounted inward from the center of the boilers. Fig. 1 shows how these measures permitted a pit of adequate volume. Because of the sloping pit wall, plastic refractory facilitated construction of the firebox. Insulation was placed between the refractory and the concrete of the footing and the steel plate of the base.

By means of modern temperature controls, the heating of the building has also been rendered more uniform and comfortable, and the results have been even better than anticipated. A single boiler carries the load except in severe weather, and the fuel cost has been considerably reduced.

Firing Oil at Night, Wood During Day

Another case involves a water tube boiler in a saw mill, where an abundance of wood refuse provided ample fuel but required constant fire room attendance. The mill's process includes a soaking operation, requiring that the logs be held in a vat of warm water overnight so as to be suitable for the cutting knives the following morning. If means could be provided to maintain steam pressure on the boiler, no other supervision of the plant would be needed. Obviously, only some form of automatic firing could give a continuous steam supply overnight without requiring the presence of a fireman. So the problem outlined was to arrange for burning oil at night and wood refuse during the day.

The grates, chutes and other accessories for wood burning were installed in a conventional manner at the front end. To burn oil it would be necessary to rear fire the boiler, without disturbing the front arrangement. Fig. 2 shows details of the boiler setting, and the changes that were made to modify it for combination firing. These changes involved principally the bridge wall, baffles and rear wall.

As originally arranged for grate firing either coal or wood refuse, the bridge wall reached to the lowest row of tubes and a vertical baffle extended from the top of the bridge wall to the top of the tube bank. Toward the rear, another baffle extended downward from the top of the setting to the second row of tubes, thereby creating three passes across the tubes. However, only the front half of the lower tubes were exposed to radiant heat from the flame. In order to rear fire with oil, the bridge wall height was reduced, a horizontal baffle was laid over the first row of tubes from the rear wall to the front vertical baffle, and the former rear vertical baffle was replaced by a much shorter one, to separate the second and third passes.

The combustion space made available for the oil burner easily permits developing the boiler to 200 percent of rating. The extra surface exposed to radiant heat in the lower tubes makes for faster steaming and improved efficiency. The setting now permits almost instant conversion from one fuel to the other, and in fact allows burning both fuels simultaneously if desired.

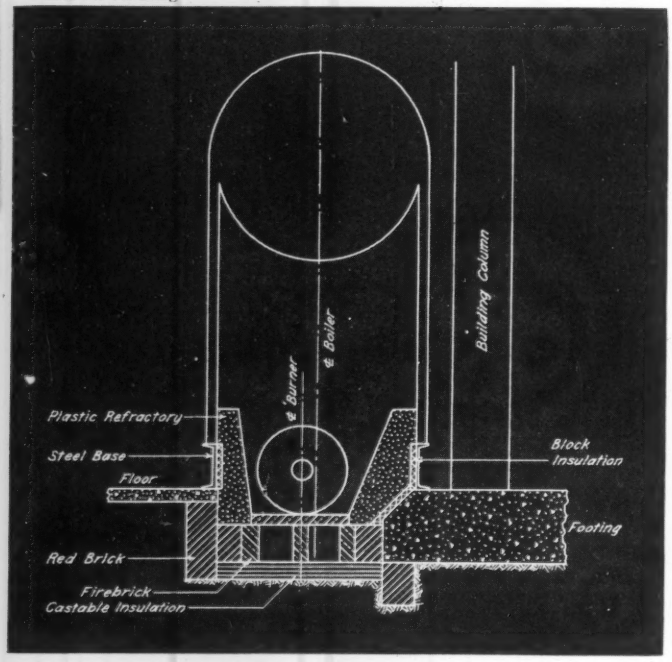
Excavating a Pit in Swampy Land

Yet another case pertains to a one story factory, built in swampy ground. The heating boiler had been set with the usual shallow base for hand firing. To fire with oil required much more setting clearance. There was not sufficient ceiling height to raise the boiler. As soon as attempts were made to excavate a pit, the swamp water poured into the excavation. In certain cases of underground water, a successful method of pitting is to keep pumps running during the excavating operation and while a waterproof concrete pit lining is formed. But conditions here were too severe, and some other solution had to be found.

By using pumps the excavation was kept dry until a pit of correct dimensions had been dug. Then a steel pan was made, of the exact dimensions to fit the pit, which extends from the rear water leg to about 3 ft in front of the boiler. The pan was constructed of ¼ in. steel plate, with welded corners. After fabrication, the outside surface received a coat of hot pitch. Setting of the heavy pan into position was accomplished by letting it float downward while the water was being pumped out of the pit, which of course had filled with water as soon as the pumping was interrupted. The pit actually was drained through a slot and sump dug off to the side. While the pumps kept running, four heavy angle clips were set vertically, one at each corner of the firebox, welded at the top to the water legs and at the bottom to the sides of the pan. After that, the refractories erected inside the pan gave ample assurance the pan would stay down.

An alternative to the problem of pitting under severe water conditions (when raising the boiler is not feasible, and if the boiler load is not too heavy) is to cut away that portion of the water leg in the front wall, between the base and the firing door, and then to weld steel strips across the opening between the inner and outer boiler sheets, thus closing up the water leg. The burner plate can then extend up to the firing door, which usually affords the required clearance for the burner and firebox floor. However, this method cuts down the combustion volume and of course restricts the amount of oil that can be burned.

FIG. 1—IT WAS NECESSARY to chamfer off a corner of the footing from the edge that extended along the longitudinal axis of the boiler to gain clearance for oil firing



Laundry Can Use Either Coal or Oil

A certain laundry has two hrt boilers, one oil fired and one stoker fired and each capable of developing slightly over 400 hp. Usually, the load can be carried on one boiler, but occasionally runs high enough to require both boilers. This means that two kinds of fuel must be stored and handled. The management felt it prudent to retain the stoker should a switch in fuels become necessary. What was needed, therefore, was a temporary oil burner installation that

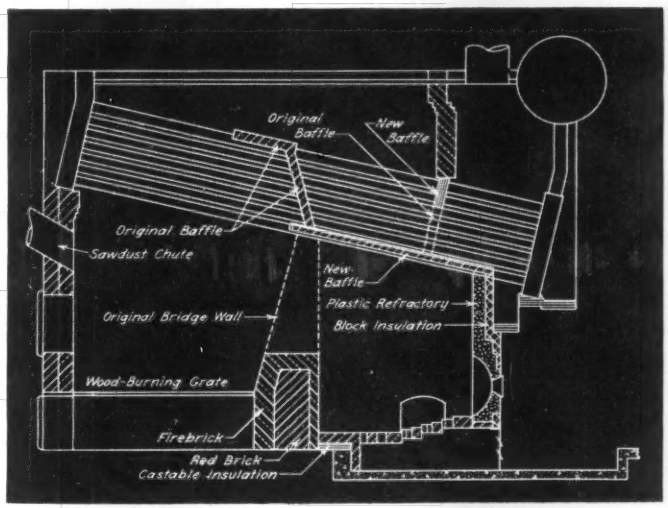


FIG. 2—AT A SAW MILL, this boiler is fired with wood refuse during the day and oil at night. The changes involved principally the bridge wall, baffles and rear wall

could fire over the stoker retorts and dead plates, and be capable of quick removal if it was desired to resume coal firing.

The objective was attained by using steam atomizing nozzles. A steam nozzle can be inserted through a front wall with very little clearance, and the flame tailored to suit the firebox shape. A refractory covering on the stoker parts protects them from radiant heat, and introduction of secondary air through air lanes between the stoker and the temporary floor provides cooling air to remove transmitted heat. Of course the full capacity of the boiler cannot be developed because of the limited combustion space, but it still yields the additional steam needed to assist the straight oil fired boiler when the load exceeds the capacity of the latter. To convert the boiler to stoker firing requires only the removal of the refractory paving above the stoker.

The out-of-the-ordinary job can add zest to the task and profit to the job for engineers and contractors who probe below the surface in designing and planning installations to best meet the conditions that prevail and the needs of the owner.

CONSTRUCTION REGULATIONS RELAXED FURTHER

FURTHER RELAXATIONS of construction regulations beginning with the third quarter of this year, which will include permission for limited amounts of entertainment and amusement project building and the use of some structural steel in housing, were announced last month by the National Production Authority, Department of Commerce.

NPA Administrator Henry H. Fowler said this action is being taken "because the needs of the defense construction program will be substantially reduced during the last half of this year".

Mr. Fowler said the Controlled Materials Plan Regulation No. 6, the basic construction order, would be amended effective July 1 to provide for these major changes:

1) Revocation of the ban on Table I (recreational) construction and permission to self-authorize, beginning July 1, the following amounts of materials for this type of construction per quarter: 5 tons of carbon steel, not to include more than 2 tons of structural shapes; 200 lb of copper; 250 lb of aluminum.

2) Increasing the amounts of materials that may be self-authorized per quarter for general commercial construction, beginning October 1, to 25 tons of carbon steel with no limit on the portion of this amount that may be structural shapes; 750 lb of copper; 1000 lb of aluminum.

3) Revocation of restrictions in the regulation allowing use of aluminum only in industrial and public utility construction so that after July 1 it will be possible to use aluminum in all types of construction. From July 1 to October 1, 250 lb of aluminum may be self-authorized for commercial construction.

4) Reclassification from the commercial to the industrial category of construction of these types of projects: a) transportation facilities; public utility systems, water and sewage systems, administration buildings, garages and service buildings for industrial projects when owned and operated as part of the industrial project; b) crane runways and baler installations incident to scrapyard operations.

5) Permission for self-authorization of 2000 lb of stainless steel per project per quarter for construction of chemical plants.

6) An increase in the amounts of critical materials that may be self-authorized for primary schools and roads and highways.

7) Provision for the same use of finished conversion steel as now permitted for foreign and used steel.

8) Minor "housekeeping" changes in wording, for clarification.

An amendment of NPA Order M-100, the housing construction order, will allow after July 1 self-authorization of 1500 lb of new domestic structural shapes and 250 lb of aluminum in addition to the present allowance of steel and copper.

NPA pointed out that all these projected relaxations are subject to change in the event of altered conditions in the steel, copper or aluminum supply situations.

Allotments of controlled materials for the construction of 1069 commercial, religious, entertainment and municipal projects with an estimated cost of more than $337 million were also announced last month by NPA.

SELLING SEEN AS GREATEST NEED

AMERICAN BUSINESS is approaching a period when the need for real, creative selling will be greater than at any time in the long history of U. S. salesmanship, Harold W. Sweatt, president of Minneapolis-Honeywell Regulator Co., declared recently when he accepted an award from the Sales Managers Association of Philadelphia.

Graphic Master Panel Controls White House Air Conditioning

A color coded, schematic process diagram of the air conditioning system for the modernized Executive Mansion simplifies operation. The master panel board maintains supervision over 106 thermostats and temperature controllers, 112 valves and motorized valve assemblies, and 97 relays and switches . . . . Gordon Cole, Minneapolis-Honeywell Regulator Co., describes it here

A UNIQUE AIR conditioning master control panel provides a color coded, schematic process diagram of the summer cooling and winter heating system in the Nation's "first home" —The White House. It affords a single technician a complete running story of the conditions throughout the Executive Mansion—including the operating status of the thermostats, the valves, dampers, fans and switches comprising the major portion of the automatic controls for heating, ventilating and air conditioning.

It's a far cry from the days of the building's first inhabitant, President John Adams, when a small army of wood-toting servants had to scurry about the building to try to keep the rooms comfortable.

The pictorial "color graphic" supervisory control panel is one of the earliest (if not the first) of its type to be developed for supervision of commercial or residential air conditioning systems. These graphic type panels, utilizing coded and simplified flow diagrams, had their origin in such processing applications as the oil industry.

Although as early as 1937 relatively simple flow diagrams were employed on the control boards found in refineries, it wasn't until the years following World War II that the graphic panel concept spread and panels of this type received wide acceptance and were engineered and produced for the processing industries. However, even today, relatively few installations and processes are "graphicized."

Graphic Panel Offers Several Advantages

The graphic panel offers several advantages. For example, from the centralized control panel in the White House it is possible to:

1) Read the control points of the 106 thermostats throughout the building.

2) Change the control settings of these thermostats.

3) Check the positions of the many air dampers and valves.

4) Note all of the pertinent air temperatures and critical equipment temperatures.

5) Observe the sequencing of the many control units and check conditions in their logical order.

6) Obtain an overall, true graphic picture of the entire system.

The harmonizing colors used on the panel serve as a swift and sure means of identifying the various flow lines, ducts and components of the air conditioning units. The basic colors employed for coding purposes and the equipment they represent are: dark blue—ducts and fans; red—steam flow lines and valves; green—chilled water flow lines and valves; gold—spray water flow lines and valves; black—dampers and damper motors, room thermostats and temperature controllers; and silver—control lines and relays.

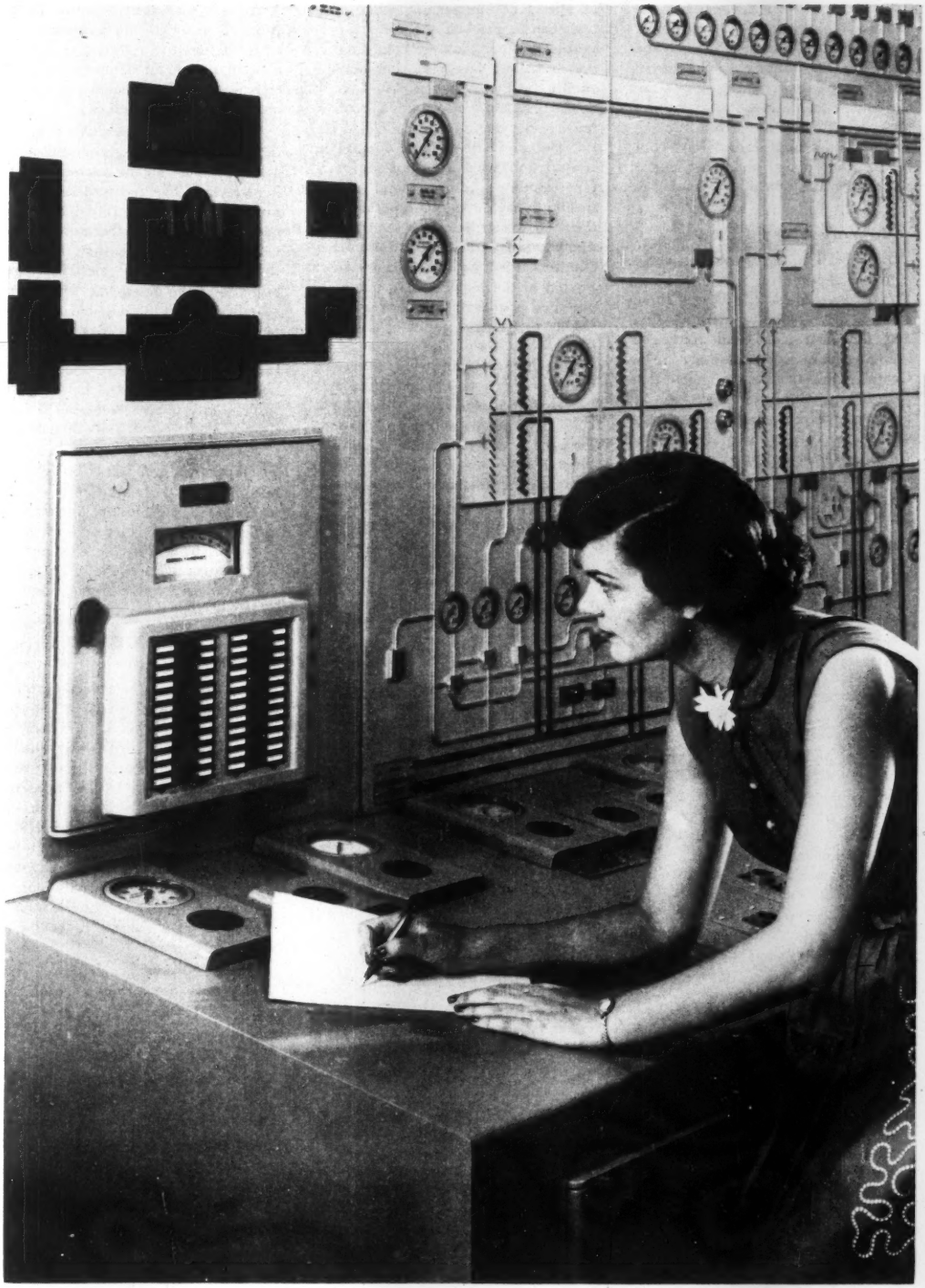
In addition, the many descriptive plexiglas nameplates are color coded to identify particular equipment functions or locations.

All of the temperature controllers and primary components of the control systems are of the pneumatic type, utilizing compressed air as the signal transmitting medium. Electrical operations are performed in their proper sequence through pneumatic-electric relays. These relays receive pneumatic impulses from key controllers, and then electrically transmit signals to appropriate pieces of electrical equipment.

Shown on the pictorial master panel are two entirely separate segments of the entire air conditioning system. The smaller section of the panel, set off from the balance of the panel by a separation in the steel base, contains schematic floor plans of the building and precision instruments for indicating and recording the temperatures at selected stations throughout the building. The rest of the panel comprises the supervisory controls and pictorial layouts of the five basic systems used for air conditioning the mansion.

Quick and simplified temperature indications are facilitated by the unique graphic tie-in between the lettered transparent floor plans of the

TO CONTROL WHITE HOUSE TEMPERATURES — This graphic electronic control panel keeps temperatures just right in all parts of the Executive Mansion. The specially designed monitoring board is shown just before shipment from the manufacturer's plant. It automatically and constantly records and controls the temperatures and other atmospheric conditions in each room of the modernized historic structure. The operator can make adjustments for each part of the building directly from the panel



structure (on the left panel section) and the 30-point temperature indicating instrument mounted directly below. The 30 buttons on the instrument represent critical space and equipment temperatures. These buttons, or switches, are wired into separate lights behind the various rooms in the floor plans, and the lights at the top of the board.

Here's How It Works

In operation, here's how it works. When the button labeled "Green Room" is pushed, the Green Room alone is illuminated on the floor plan, and the instrument dial rotates to indicate the exact temperature in the Green Room. Critical equipment temperatures are indicated in a similar manner, different signal lights at the top of the panel being illuminated when various buttons are pushed. The temperature indicating instrument is of the electronic Wheatstone bridge type, which measures temperatures at remote points by electrically connected resistance thermometer bulbs.

On the bottom left side of the console, or "bench board" portion of the panel, is a two-pen recording instrument which automatically logs the temperatures of the chilled water leaving each of the refrigeration compressors located hundreds of feet away. This recorder is a pneumatic receiving instrument which gets its impulses from locally mounted pneumatic temperature transmitters.

The transmitters, which translate the temperatures into pneumatic signals, are gas filled thermometers with their temperature detecting bulbs mounted in the chilled water lines. Continuous records are desirable as a compressor operating guide so that the overall refrigeration load can be evenly distributed. Control switches on the panel make it possible not only to control the chilled water temperatures, but also to adjust the loads of each refrigeration machine independently.

The real "brain" of the White House air conditioning installation is the major portion of the panel (right panel section) controlling the five basic central fan systems. From this central point, the engineer in charge has the whole operation at his fingertips. Temperature control settings may be changed: fans, blowers, pumps and auxiliary equipment can be operated; damper and valve positions can be checked—in short, supervision of a complex air conditioning system from a single location is made simple.

The console portion of the panel has a series of signal lights coded Hi, Lo, On, and Off. These operate in conjunction with the start-stop buttons mounted above them. These pushbuttons control the operation of the many electrically operated pumps, fans, blowers and the electric auxiliary equipment. Another section of the panel houses manually operated pneumatic switches used for setting the control points of the room thermostats.

Five diagrammatic flow networks, complete with color coded equipment representations and two sizes of circular gages, are centrally located on the upright section of the panel. The larger gages are temperature indicators of the pneumatic receiver type. They receive their signals from locally mounted pneumatic thermometer transmitters. Two of these gages indicate outdoor wet and dry bulb temperatures. The others indicate interior temperatures of their respective ducts. The small dial gages, which indicate individual damper or valve positions, are all pneumatic receivers with specially engraved dials calibrated in terms of position rather than the standard "psi" marking.

The Control Sequencing

Even though the systems vary considerably, the control sequencing is quite similar for all. For example, System No. 2, encompassing the majority of the rooms on the ground and first floors (12 zones in all), employs one thermostat for each zone or space. This control dictates the amount of hot and cold air delivered to the zone, by proportioning a duplex hot air-cold air damper in the zone's discharge duct. The control setting of the thermostat can be read and remotely changed from the master panel.

During year 'round operation, the various dampers (outside air, auxiliary outside air, exhaust air, return air and static pressure); valves (steam, chilled water and spray water); and duct mounted controllers operate in a definite sequence to produce certain design conditions at the discharge of the main control fan. A manual "Summer-Winter" switch is interlocked with the main duct controls so that the return air, exhaust air and outside air dampers are properly positioned depending upon the outside ambient conditions.

Heating of the Executive Mansion during the winter is accomplished by a low pressure steam convector heating system. The recessed convectors are individually controlled by pneumatically operated thermostats and valves, interlocked with a series of control-point-setting electric time switches in the basement. These time switches make it possible for one person to change the day and night thermostat settings of the various rooms and the times of their operation. In other words, the temperatures in any of the rooms can be easily adjusted to suit individual tastes.

The master panel has 91 air lines feeding into it and 102 electrical connections for the equipment (exclusive of the pushbutton temperature indicator.) The panel maintains supervision over 106 thermostats and temperature controllers, 112 valves and motorized valve assemblies, and 97 relays and switches.

CRYOGENIC STUDIES INTENSIFIED

NEW EQUIPMENT for achieving ultra-low temperatures through quantity production of liquid helium has led to greatly intensified study of the behavior of matter near absolute zero, —459 F, according to the Industrial Bulletin of Arthur D. Little, Inc. In 1945, there were only seven laboratories in the United States equipped to work at this end of the temperature scale; now there are about 50 cryogenic (cold generating) laboratories, of which about 10 belong to industrial groups.

One experimental result of cryogenic study is extremely hard stainless steel prepared by immersion in liquid nitrogen at —320 F and rolling or forging at controlled temperatures. Apparently the low temperature slows down thermal motion of the atoms, and rolling then rearranges them in a pattern which imparts increased hardness to the steel. Such a steel may find application in bearings, valve seats, and other machine parts where high strength and hardness, as well as corrosion resistance, are desirable.

Piping Services for an Organic Research Laboratory

Meticulous compounding of certain chemicals is carried on in the 12 booths or work cubicles at the Wm. S. Merrell Co.'s new organic research laboratory. Frank L. Bonem describes the piping services required, and gives details of their installation

IN THE RECENTLY completed organic research laboratory of the Wm. S. Merrell Co., Cincinnati, 12 booths or work cubicles are provided — each is fitted with every service needed for safe and efficient experimental drug preparation.

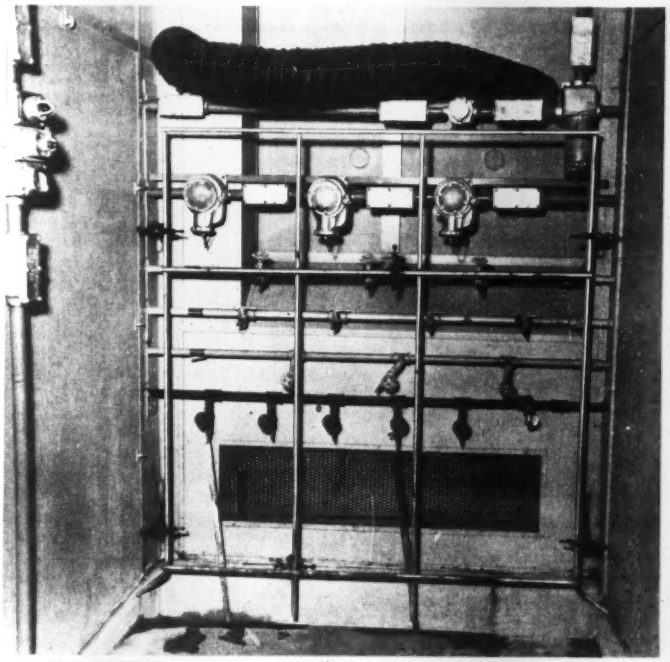
The "heart" of the operations in these booths is the meticulous compounding of certain chemicals — for which steam, compressed air, cold water and a vacuum are necessary. For the entire building, however, piping carries (in addition to the above mentioned services) hot and distilled water, high and low pressure steam, gas and condensate.

All the piping — except the condensate line — enters the building from a pit 3 ft wide, 31½ ft long, and 3 ft, 10 in. deep, located immediately adjacent to one of the outside walls. Each of the lines in this pit is provided with a gate valve and a plugged tee, the latter being inserted for possible future take-offs. The pipe sizes, as they enter the building, and the pipe materials are:

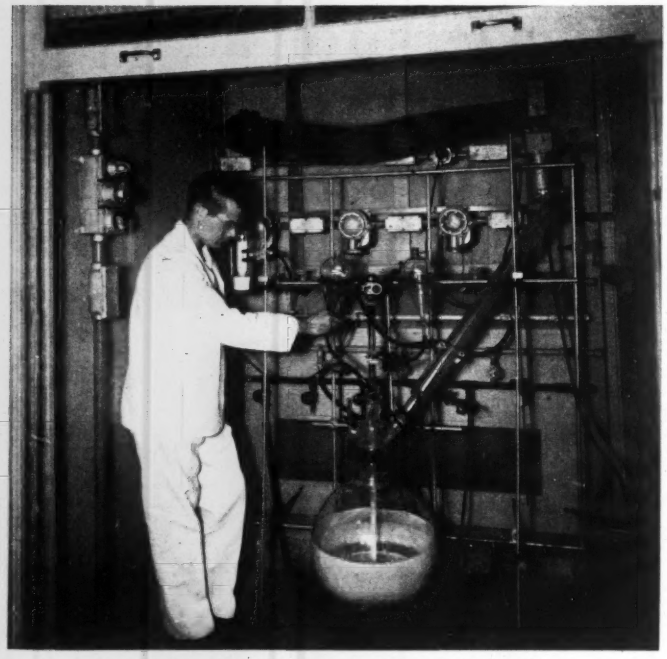
Low pressure steam, 3 in., black steel.
High pressure steam, 1 in., black steel.
Distilled water, 1 in., aluminum.
Gas, 1 in., black steel.
Air, 1 in., black steel.
Hot water, 1 in., black steel.
Cold water, 1½ in., galvanized.
Vacuum (to other building), 1½ in., black steel.

The condensate line leaves the building immediately adjacent to the condensate pump, which is in a pit 3½ ft by 3½ ft by 3 ft located under the locker room next to an outside wall. All steam loads and steam lines are trapped and the condensate is returned to a reservoir next to the pump through a gravity flow system. The pump, which can be operated manually or automatically, is rated at 15 gpm against 15 psi discharge pressure, and returns the condensate through a 1¾ in. line to the boiler house.

From the entrance pit, the pipes run underground to a safety wall which separates the two wings of the laboratory (each of which houses six cubicles) from the rest of the building. The pipes rise along this wall at 8 in. on centers and have a valve in each riser. Through tees, the lines



ONE OF THE 12 explosionproof cubicles in which experimental production of pharmaceuticals is carried on. Services in the booth are, from top to bottom, 8 in. flexible hose connected to the exhaust manifold; thermostat and motor connections; three explosionproof electrical outlets; three vacuum cocks; four compressed air outlets; three steam outlets; six cold water outlets; and an exhaust air grille. The pushbuttons at left control the automatic ventilating system; the lever switch controls the cubicle lights.



AN EXPERIMENT BEING conducted in one of the cubicles

branch off to feed the south wing by going through the wall, and form an open rectangle along the ceiling of a storage room to feed the north wing. All lines, except the insulated steam lines, are color coded in addition to being labeled.

Provisions Made for Future Needs

Almost all of the turns in the lines are made by plugged tees. The reason for this, according to Rowland Kleine, Merrell engineer and one of the designers of the building, is to allow for future additions and to simplify general maintenance.

The high pressure steam line, for saturated steam at 150 psi, further illustrates the outlook toward the future which the engineers took in the design of the piping system. At present, this line is not used for anything, being cut off by a valve and cap after passing through the safety wall. It was installed solely in anticipation of possible future needs.

The 3 in. low pressure steam line carries steam at a maximum pressure of 15 psi. Two $3/4$ in. branch lines enter the north and south wings through the safety wall to service the work cubicles. The main line furnishes steam to the two air conditioning units which temper all air going through the ventilating system. Low pressure steam is also used in the hot water heater hung from the ceiling in the storage room, and in two overhead unit heaters located, respectively, in the corridors of the two wings. Steam is also supplied to a convector heater in the glass blowing room, two heaters in the mill room; and heaters in the toilet and locker rooms.

Take-offs from the main $1\frac{1}{2}$ in. cold water line serve the washroom, in which there are two showers, a toilet and a washbasin; a drinking fountain and an eyewash fountain; two emergency safety showers; a work bench in the storage room; a fire hose stand; and the hot water heater. There is also a take-off to the vacuum pumps, which are water sealed.

The hot water line's primary functions are to serve the hot water heater and the washroom showers. There is, however, one $3/4$ in. take-off to a work bench.

The gas line is installed along the ceiling of the storage room to the glass blowing room, where it ends in three $3/8$ in. cocks to which glass blowing burners may be attached.

Piping that carries compressed air is hung in a manner similar to the rest of the pipes in the storage room. A $1/2$ in. line feeding to the work bench and a $3/4$ in. line feeding to the mill room and ending in a $3/8$ in. air cock are the only other branches beside those running to the cubicles.

The vacuum lines differ in that they originate in the mill room, where two vacuum pumps rated at 52 cfm at 28 in. of mercury are located. A duplex and parallel system connects the pumps to two vacuum receivers. Three $1\frac{1}{2}$ in. lines lead from the receiving tanks. Two lines follow the general shape of all other piping along the ceiling, with one line branching and going into the two wings and the other leaving the building. The third line is connected directly to a vacuum oven in the north wing. Due to the duplex and parallel piping between pumps and tanks, the ideal laboratory situation of two different vacuums — one in the oven and one in the booths — can be obtained.

The line carrying distilled water has a $3/4$ in. take-off to the work bench and two main branches which run parallel along the inside walls of the two wings, opposite the work cubicles. The lines terminate in two $3/4$ in. sanitary faucets located in the center of each wing.

The Piping in the Work Cubicles

Piping in all cubicles of both wings is the same. The pipes pass from the storage room through the safety wall at a point slightly below the ceiling and descend 7 ft. 3 in. to the lowest elevation. The risers are 8 in. on centers and have one valve each. The pipes run along the inside of the "blowout" safety walls of each wing. They are supported 4 in. away from this wall by means of a No. 8 ga angle iron which is 1 ft. 1 in. high, and has six slots — four for the piping and two for electrical conduits. The lowest pipe is the water line and it is 2 ft. 3 in. from the floor. All other pipes are 6 in. on centers.

Outlets in the cubicles vary according to what the pipes carry and are as follows (from top to bottom):

Vacuum line — three $3/8$ in. globe valves 1 ft. 1 in. on centers (center line of center valve on center line of booth).

Compressed air line — four 3/8 in. air cocks 9 in. on centers (cocks equidistant from center line of booth).

Steam line — three 3/8 in. globe valves with st. ells 1 ft, 3 in. on centers (center line of center valve on center line of booth).

Cold water line — six 3/8 in. globe valves 1 ft, 3 in. on centers (valves equidistant from center line of booth).

The possibility of future need for another outlet in any of the lines in any booth has been foreseen; each line has a plugged 3/4 in x 3/4 in. x 3/8 in. tee in each booth. All valves and cocks are equipped with serrated straight hose connectors.

"Putting the Cart Before the Horse"

Installation of the piping was simplified by "putting the cart before the horse"—assembling the complete length of pipe for each wing prior to hanging it in the supporting brackets. This was made possible since the pipe brackets were fastened directly to vertical 10 in. steel columns before the removable asbestos-cement board partitions were installed.

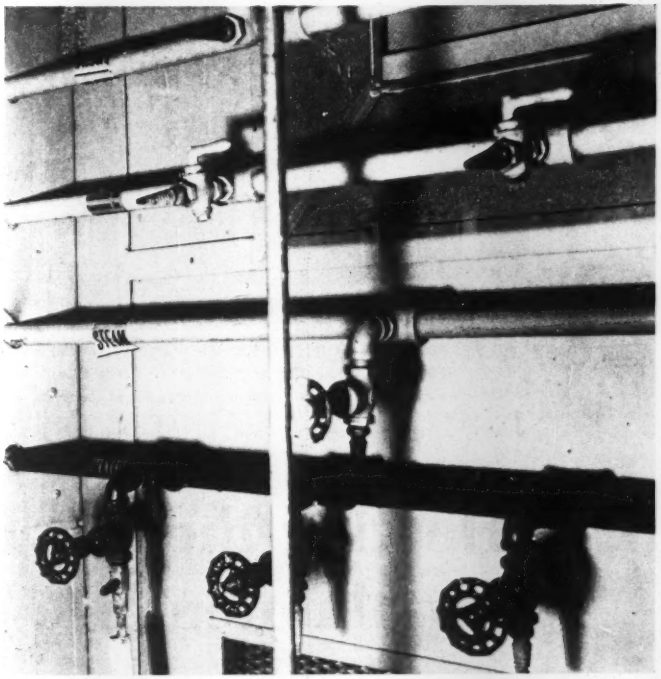
Latest alterations in the laboratory consist of two take-offs from the main hot water line, which run into each wing along the inside walls similar to the distilled water line.

The ventilation of this laboratory was described in an article in the April HPAC. The consulting engineers were Harold N. Hermann & Associates, the general contractor was Frank Messer & Sons, Inc., and the ventilation and piping contractor was Henry Niemes, Inc.

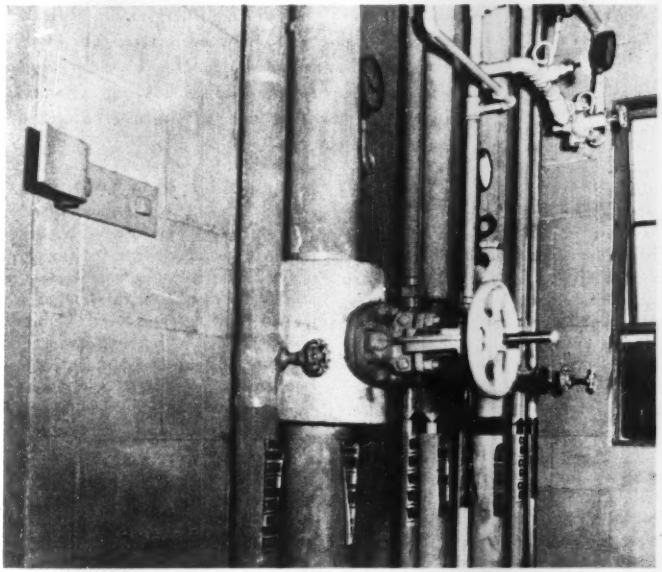
MEASURES FLAME RESISTANCE OF ACOUSTICAL MATERIALS

A NEW, AUTOMATIC method of measuring flame resistance qualities of sound conditioning materials has been announced after almost a year of research conducted by the Armour Research Foundation of Illinois Institue of Technology for the Acoustical Materials Association.

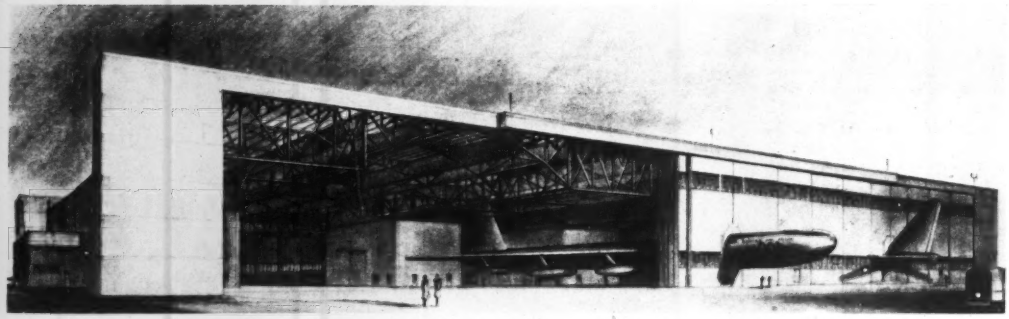
It is the first automatic method for analyzing the flame resistance of acoustical materials used in offices, industries, institutions and homes, according to Luther G. Ramer, supervisor of the Riverbank Acoustical Laboratories, operated by the foundation at Geneva, Ill. He also said that the new method eliminates guesswork from such studies.



CLOSE-UP OF THE SERVICE lines and the supporting bracket in a work cubicle. The fitting on the far left water valve is an aspirator, a means of obtaining a small partial vacuum



VIEW OF THE PIPING as it emerges from the underground tunnel and rises along the safety wall. From left to right are the high pressure steam, low pressure steam, vacuum, hot water, compressed air, cold water, city gas, and distilled water lines



HANGARS FOR THE HEAVY BOMBER or transport planes are 600 ft long and contain four shop towers. A radiant coil system containing an anti-freeze solution is used to prevent icing at the doors

Heating the Air Force's New Maintenance Hangars

The Kuljian Corp. (architects-engineers-constructors) was selected by the Corps of Engineers to design a new type of hangar for the Air Force. Three basic types are involved, one of them being an expansible hangar. . . . . Staff engineers of Kuljian describe here the method of heating, as well as the other features. The heating design combines floor radiant panels and steam unit heaters

THE KULJIAN CORP. was selected last September by the United States Army Corps of Engineers to design a new type of airplane hangar capable of housing any of the existing or future aircraft presently planned for use by the United States Air Force and providing for the complete maintenance and repair of such aircraft.

Three basic types of hangars are involved, each of which is 250 ft wide with over 60 ft clear height in the airplane bays. The first is a hangar 350 ft long and containing three 3-story shop towers for aircraft of the medium bomber class. The second, for aircraft of the heavy bomber or transport class, is 600 ft long and contains four shop towers. The third is an expansible type of hangar, which starts with the smallest basic unit of the double cantilever hangar that is possible to provide the minimum acceptable facility for any installation. This basic unit has an initial length of 250 ft but is capable of being expanded intermediately to a hangar for the medium bomber class and ultimately into a hangar for the heavy bombers or transports.

The simplest way to picture these structures is to imagine a series of gantry shipyard cranes on the same track and spaced 60 to 120 ft apart. Place transverse arches between the "cranes", install a wall up the ends, and cover the sides with 60 ft high rolling doors and you have your hangar. Add floors, roofs and masonry walls to each gantry tower and you have the shop towers.

Radiant Heating and Unit Heaters Combined

The two most unusual features of the mechanical equipment are the unprecedented size and shape of the hangars, and their use of standardized equipment. The largest of the hangars requires enough steam to heat a community of 250 average homes, and their rectangular cross section is a somewhat new departure in large hangar types. Another innovation is the location of shops in the centers of the hangars instead of along the sides.

The heating problem consists of designing for a main hangar area temperature of 60 F and a shop temperature of 70 F. A combination of floor panel radiant heating and steam unit heaters, with the provision that no overhead steam and condensate piping would be permitted, was requested by the government. Since these hangars are to be built at various sites, separate designs were required for temperature zones of minus 20 F, 0 F, and plus 20 F. The walls, including the main doors, are corrugated metal and are insulated. The roof deck is metal pans, also insulated.

Calculations for heat losses were made in the conventional manner, except that credit for warm shop walls and any reduced loss with radiant heat was disregarded, primarily because (except for the plus 20 F zone) the radiant heat effect is less than half the heating load. Infiltration, a variable which accounts for a considerable portion of the heating load, was arbitrarily established at one air change an hour. Such items as lighting, body heat and incoming airplane temperatures were disregarded since they are insignificant when compared to the main heating problem.

Basic radiant heating design limitations are a 90 F maximum floor temperature, 140 F maximum water temperature with a maximum temperature drop of 20 F, and a minimum pipe depth of 8 in. In view of the high pressure drops necessary with serpentine panels, grid type panels are used. Concrete aggregates for the floor slab are limited to those which produce a concrete of high heat transfer properties, and existing curves for the rate of heat transfer were extended until the rate for 8 in. depth could be estimated. Since with 24 hr continuous duty the floor will always be in the "soaking" condition, this estimate is expected to be fairly accurate.

Calculations disclosed that the maximum heat that could be developed from the floor panels would not satisfy the heating demands for any zone. This simplified the general design of the floor panels, since this maximum is required for all zones.

The number of different types and sizes of floor panels is kept to a minimum consistent with the spacing of the bays and the expansion joints. Use is made of a center escape tunnel the full length of the hangar as a general utilities tunnel, and the floor panels, which are symmetrical each side of the center line, are fed and controlled by valves and headers in the tunnel. Because of the center line floor slab expansion joint and shallow fill over the roof of the tunnel, care was taken to locate the entry into the slab of the supply and return pipes well to each side of the tunnel walls, thereby minimizing the possibility of slab cracks developing in this area. Complete floor coverage by the panels is accomplished by routing the return pipe and header to the edge of the expansion joint. The grid pipe supply headers are along the outside edges of the hangars and with this arrangement it is expected that "hot spots" will be minimized.

The grids are $1\frac{1}{4}$ in. pipe size and the grid supply pipes are 2 in. Each grid is controlled by a gate valve in the supply line and a plug valve in the return line. For all but the smallest hangar type, the supply mains are divided into two systems each with its separate pumps, steam heated converter and outside temperature actuated control valve. Constant pump suction head is maintained with a small elevated tank which is vented to atmosphere and provided with an overflow and a float operated make-up valve.

Locating the Unit Heaters

Each temperature zone design requires the use of unit heaters for the main hangar area. Floor mounted units were first considered, but would have required trenching the service piping, recessing the units into walls and locating duct work in exposed locations close to working levels.

The location selected for the unit heaters is on the shop tower roofs 39 ft above the main hangar floor. This removes the units from usable work areas and allows service piping to be accessible yet inconspicuous. To insure positive diffusion of air, the units are sized to provide large amounts of moderate temperature air discharging at relatively high velocity. Where necessary, short outlet ducts are used to direct the air over the entire floor. Stratification is minimized by drawing in air for circulation at a level 7 ft above the main floor and conveying it through vertical ducts to the unit heater intakes. Temperature control is by thermostats in these return air ducts and the steam coils are bypassed with the amount of air required to produce the proper temperature.

It is expected that the combination of radiant floor panels and unit heaters will prove highly flexible for all applications and will readily lend itself to modifications for specific requirements.

Heating and ventilating the shops is in general simplified by their uniform design and the fact that, except for the end shops, the "outside" (hangar) temperature is constant. Air is drawn in from the area above the shop roofs, heated and forced into the various shop floors through a conventional forced warm air steam coil unit and duct system.

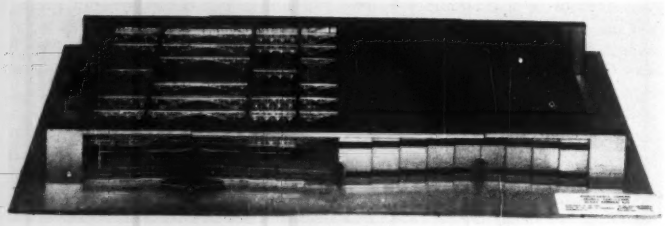
Toilets are ventilated by a single fan per shop tower which exhausts the air through the hangar roof. The service pipe space is used as the exhaust duct, and warm air is drawn into the toilet rooms through louvers near the ceiling in the walls between the toilets and the shops. The toilet room air is exhausted into the pipe space through grilles at the floor levels.

Shop air in excess of the amount used for toilet ventilation is exhausted by gravity through two corner vent stacks to the top of the shop towers, where it is either mixed with hangar air and recirculated or is vented outside the building through the roof ventilators. Such an arrangement minimizes the number of pieces of equipment and provides a base system for air conditioning wherever this requirement is deemed necessary.

The end shop towers are provided with unit heaters to provide for the extra heat loss resulting from outside walls and windows.

Main Doors Present An Icing Problem

The main hangar doors present a problem of ice conditions during sleet storms. This, however, should not be as severe a problem as would normally be expected, since the hangars are for maintenance only and are not expected to be ready for momentary run-outs. The problem was approached from the "anti-icing" viewpoint—that of creating a moderately warm surface adjacent to the



THIS MODEL OF A MAINTENANCE hangar illustrates particularly the roof construction, which is of the double cantilever type

door tracks and extending the melting time.

The problem is solved by a radiant coil system similar to the main system in all respects except that, because anti-freeze solutions are required, the circulating system was designed to operate with a closed expansion tank. The solution may be tested and additional anti-freeze added through a bottle which creates a small bypass from the pump discharge to the pump suction.

Boilers Are In Utility Lean-To

The boilers and other utilities are in a lean-to on one end of the hangar. Where heating facilities are divided, a utility lean-to containing a converter, pumps and a condensate return unit is located on the opposite end of the hangar. Where central steam is available, the boiler house is replaced by a utility room with necessary reducing valves and return units.

Steam at 40 psig is supplied to all heating units. Since the unit heaters require no modulating valves, there is sufficient pressure to force the condensate back to the vented receiver in the boiler house. The steam to the radiant heating converter in the utility house is modulated and it is therefore necessary to pump the condensate from this unit back to the boiler house tank. Such an arrangement is trouble-free if properly maintained.

The boilers are of the portable steel firebox type. Capacities were determined on the basis of 100 percent boiler rating with an 80 percent load factor, which provides full design demand when the boilers are operating within the specified limit of overload. A small boiler is also provided for a regulated and constant steam supply during the summer months for heating domestic hot water and for the process steam.

The boiler house is arranged so that either coal, oil or gas can be used without structural changes to the building. No attempt was made to design for combination firing.

All equipment was selected so that, as far as possible, standard units could be used. All pumps, regardless of purpose, are specified double suction, horizontally split in order to minimize the number of spare parts.

Expansible Hangars Pose Special Problems

The design of the expansible type hangars involved some special economic problems. Since the basic unit will be selected with the thought of expanding to a larger hangar in the future, the selection of equipment for the basic hangar or for the intermediate medium bomber stages had to be balanced by the higher initial cost of oversized capacity for the basic stage over the much higher cost of revising all facilities when the hangar is enlarged. Generally, the equipment selected for the basic installation is sufficient for the intermediate stage, and additional units are provided for the ultimate stage. Thus, cost of heating facilities for the expansible medium and heavy bomber hangar will only slightly exceed the same costs for the permanent medium and heavy bomber hangars.

Sprinkler Piping for the Hangars

One of the most important phases of the design of the hangars is the control of fires. In close cooperation with the Army engineers, Kuljian explored several possible methods of applying the deluge type sprinkler system to the physical characteristics of the buildings. Draft curtains at roof level were finally located to isolate areas no greater than 7000 and no less than 3750 sq ft. A separate deluge system is placed in each of these areas, except that the closed head wet pipe system which serves the shops is extended to protect the areas directly over the shops. The many similar bays in all the types of hangars permit standardization of types, each designed to secure uniform flow rates within the minimum established by national safety standards.

The sprinkler systems are supplied by a 16 in. main extending from a central fire pump house beyond the construction limits. The main is located at the floor level of the escape tunnel. The system feed mains branch from stub laterals on the 16 in. main. To eliminate congestion in the tunnel, recesses are placed adjacent to each opposing shop wall. The main is straight, and the stub enters the recess which houses the individual system gate valves. All other service piping is looped around the walls of the recess, thus automatically providing expansion for the service piping. Expansion in the 16 in. main is absorbed by sleeve couplings.

The branches pass through the tunnel recess walls, into the fill under the ground floor slab, and then through the main floor slab, where they are connected to the deluge control valves (which are arranged in groups of two and three each side of the central shop doors). These main groups are in the center of the total area which they protect and are readily accessible from the most sheltered locations if manual tripping is necessary.

Drainage Piping an Interesting Problem

Even with what is believed to be the most effective and least water consuming system, it is expected that a fire at practically any location within the main hangar area will cause a deluge rate of between 7000 and 8000 gpm, which is the equivalent of about 21 in. of rainfall per hr — five times the very conservative standard used in designing for ordinary surface drainage. The removal of this water is one of the most interesting problems of the design.

The entire area of each hangar is divided into four watersheds, each with its own drainage lateral. Laterals are located on each side of the row of shops so that no drain pipes

cross the escape tunnel. Area drains with 10 or 12 in. outlet pipes are located generally in the center of a floor area covered by one deluge sprinkler system. Roof drains are fed into the same lateral. To avoid horizontal pipe lines (except for the sprinkler system) all roof rain water drains are located adjacent to the shop areas. This requires large rain conductors and extended travel of unchannelled water, but on the other hand it assures more uniform roof load distribution — an important structural feature.

Sanitary drainage parallels the storm drainage except that since all toilets are grouped on one side of the shops, only two laterals are used. Vent stacks are necessarily carried through both the shop roofs and the hangar roof.

Electrical power is supplied the hangar at the primary distribution voltage which may be available at the site, and is transformed in a load center unit substation to 120/208 volts, three phase, four wire, 60 cycles. The load center unit substation consists of a primary disconnect switch, a three phase transformer, a main secondary air circuit breaker and several feeder air circuit breakers. The primary disconnect switch and secondary air circuit breaker are key interlocked to insure safe and proper sequence of operation. The power is distributed from the load center to the various lighting and power panel boards located near their load centers.

In the basic and expanded type heavy bomber hangars, two 500 kva load centers are provided. One is in the boiler house at one end of the hangar and the other in the utility room at the other end. In the basic medium bomber hangar, two load centers are also provided — one 500 kva and one 300 kva. In the medium bomber expansible hangar, two 500 kva load centers are provided. One of these will be relocated if the hangar is expanded to a heavy bomber hangar, and thus no changes in the load center capacity will be required. For the basic and expansible type fighter hangars, only one 500 kva load center is used.

Due to the presence of gasoline vapor in the hangars, the entire hangar floor and shop floor areas are considered a Class 1, Division 2, Group D hazardous location. All electrical work and equipment located in this area conforms to the requirements of Article 500 of the National Electrical Code. All receptacles and switches in the hazardous area are explosionproof. All lighting and power panel boards are located outside the hazardous area; thus general purpose panel boards are used.

Power receptacles are installed for supplying the supplementary power necessary in the hangar. Three phase, four wire, 100 amp receptacles interlocked with a circuit breaker and of explosionproof construction are provided on the walls of the shops and in floor pits. These outlets are used for supplying portable panel boards which are necessary to provide auxiliary light and power required for working on the aircraft. In addition to these outlets, three phase, four wire, 200 amp receptacles interlocked with a circuit breaker and of explosionproof construction are provided in floor pits for portable motor-generator sets.

The electrically operated rolling main hangar doors are supplied with 208 volt power by a three phase trolley duct, from the top door guides. Each door leaf is controlled by a constant pressure pushbutton, which is a safety factor since the operator must continually press this button to operate the door and thus must walk with the door. Limit switches at each end of the door travel insure proper positioning.

A complete automatic supervised type of fire alarm system is provided to sound local alarms, start a fire pump and transmit signals to the fire house in the event of fire. This system is tied in with the sprinkler system to insure complete automatic operation.

All building columns are grounded for adequate lightning protection. Grounding receptacles are provided in the hangar floor for grounding the aircraft.

The general hangar lighting consists of twin mercury and incandescent high bay units suspended from the roof purlins. Each unit consists of a 1000 watt incandescent and a 400 watt mercury lamp. Single lamp, high power factor, suspension ballasts are used for the mercury lamps. These high bay units are serviced by means of a mobile collapsible platform. The average maintained intensity of illumination in the hangar is 20 footcandles.

The shops are illuminated by continuous rows of fluorescent fixtures. Each is an industrial type open fixture with a porcelain enameled reflector and two 48 in. fluorescent lamps. The average maintained intensity of illumination in the shops is 35 footcandles.

Provision is made for floodlights and apron lights, which will be installed to suit the individual hangar location. Obstruction lights are mounted above the hangar roof.

EXPOSED DUCTS A PART OF ARCHITECTURAL DESIGN

AT THE UN's ECONOMIC AND SOCIAL Council Chamber at United Nations Headquarters in New York, the duct work on a part of the ceiling was left exposed to form a feature of the room's architectural design

"A Garden In Its Yard and A Railroad on the Roof"

First Floor of New Lever House Is An Open Arcade; Special Machine Running on Railroad Tracks on Roof Enables Washing Exterior of Building As Windows Are Completely Sealed

LEVER HOUSE, the new completely air conditioned glass and stainless steel office building on New York's Park Ave. "with a garden in its front yard and an electric railroad on its roof," was built for the sole use of Lever Brothers Co. and its four divisions — Lever, Pepsodent, Harriet Hubbard Ayer, and Good Luck.

The streamlined structure has the appearance of a giant letter L standing upright. The first floor is an open arcade and a glass-enclosed lobby. The second floor alone covers the entire site. Starting with the third floor, a glistening tower occupies only one-fourth of the land area.

The narrow glass tower not only provides excellent working conditions for Lever's 1200 headquarters employees, but shares with its neighbors three precious commodities — sunlight, space and air.

Lever gave most of the ground floor to the public with an open plaza and a garden with a willow tree, shrubs and flowers extending into the all-glass lobby. The open ground floor is a result of a survey which showed that this part of Park Ave. is not an active shopping area and that income from stores would not be commensurate with the capital outlay required to build them.

The landscaping is expanded to a third floor terrace, which is planted with flowering crabapple and hawthorne trees and Japanese holly. The entire third floor is devoted to the terrace and an attractive cafeteria, where Lever employees enjoy low cost meals.

Lever House is built on a conventional skeleton with more than 3400 tons of steel used in its framework. It does not float in the air nor does it sit on stilts. It is supported on conventional steel columns which,

sheathed in stainless steel, are visible instead of being concealed in walls.

The interior is completely air conditioned, with three year 'round air conditioning zones on each floor. The sunny side of the building can be cooled while the shady side is being heated and the temperature throughout is blended and balanced by the central zone on each floor. Steam turbine driven centrifugal compressors furnish 700 tons of refrigeration for air conditioning, (two 350 ton machines).

A high pressure air distribution system with high pressure diffuser units is used. The branch duct velocity is 3500 fpm, and the branch duct pressure is reduced from 4 in. to 0.4 in. of water in an expansion silencer chamber.

The steam service is supplied by the New York Steam Corp.

The blue-green glass in the building's 1404 windows is chemically treated to absorb sun heat. From the interior of the building the windows appear to be crystal clear.

In meeting the company's demand for cleanliness and comfort, the architects decided that a more efficient building could be erected at a greatly lowered cost if the windows could be sealed. The problem of washing sealed windows immediately presented itself. The architects agreed that if an exterior window washing device could be developed, wired blue glass could be used instead of ornamental brick or masonry in the areas between the windows. The company asked the architects and the consulting engineers to invent a practical window washing machine.

The electrically powered window washing machine developed consists of a 10½ ton elevator car which operates on a standard gage railroad on the roof and supports a 28 ft gondola from which two men can wash the entire outside of the building in six days.

The gondola is connected by cables to long arms on the power plant car which extend over the edge. Vertical tracks on the building prevent the gondola from swinging away from the side of the building.

The rooftop railroad is equipped with a switching device that permits the car and gondola to be stored out of sight in the middle of the roof when not in use. A telephone on the gondola connects with the superintendent's office in case of a power breakdown.

Space above the 21st floor equivalent to three floors houses air conditioning equipment, the water cooling tower and elevator machinery.

The architects were Skidmore, Owings and Merrill, the mechanical engineers were Jaros, Baum and Bolles, the general contractor was the George A. Fuller Co., and the heating and air conditioning contractor was Kerby Saunders, Inc.

HIGH SCHOOL STUDENTS URGED TO CONSIDER ENGINEERING

A CURRENT CRITICAL shortage in the United States of engineering manpower for industry and the defense effort has prompted the Advertising Council to accept an advertising campaign to urge qualified high school students to consider engineering as a career. Request for the campaign came from the Engineering Manpower Commission of the Engineers Joint Council.

The present shortage of engineers numbers 60,000. Industry alone needs a minimum of 30,000 new engineers a year for normal replacement and growth. In a protracted national emergency, the annual requirement to fill the needs of industry and government would amount to about 40,000.

As against these requirements, engineering graduates are expected to total approximately 28,000 in 1952; 19,000 in 1953; and 12,000 to 17,000 in 1954. In contrast to this constant dwindling in our own engineering talent, *Fortune* reports that Russia is training young scientists and technicians at the rate of some 100,000 a year.

To help meet this situation, the council's advertising campaign will point out to high school students and their parents the opportunities that exist in engineering today and in the years to come, and the advantages of engineering training in qualifying young men for positions of leadership in many fields.

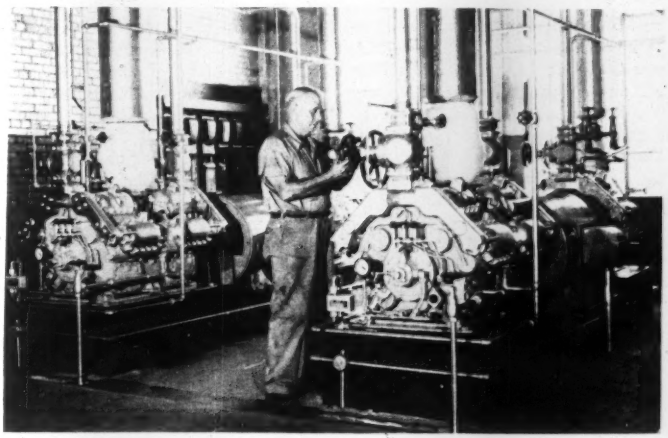
"FORT KNOX OF THE CONCENTRATE INDUSTRY"

A NEW AND CHILLING sightseeing adventure awaits the visitor to Florida. At Plymouth, a major site of the Florida frozen citrus concentrate industry, he will discover under one roof a space that has been referred to as "The Fort Knox of the Concentrate Industry."

The 2½ million cu ft Central Florida Refrigeration Warehouse is a spectacular vault claimed to be the "world's largest subzero refrigerated warehouse."

It was built to protect 6½ million gal of frozen citrus fruit concentrate of such new, fast growing companies as Minute Maid. [Photo courtesy York Corp.]

FOUR HIGH SPEED AMMONIA refrigeration compressors are installed to maintain the subzero temperature in the big warehouse. One of them is a standby



ROOF PONDING reduces the sun heat gain. Excess well water is used to fill this "lake", which is about 3 in. deep.

New Sunshine Biscuits Plant Completely Air Conditioned

Well Water Used for Many Purposes, Including Flooding of Roof to Reduce the Sun Heat Gain

By M. C. Haley, B. B. Reilly and P. C. Stephen

"ONE OF THE MOST MODERN plants of its kind in the world" describes the new Sunshine Biscuits, Inc., multi-million dollar bakery and candy manufacturing plant at Kansas City, Kansas. Krispy Crackers, Hi Ho, Cheez-Its, Hydrox and many other biscuit and candy items are Sunshine products.

The building symbolizes the "Sunshine" name, for it is flooded with light. There are 2000 metal frame windows containing 7000 panes of glass — each glare-proof and heat absorbing. No windows need be opened for ventilation, since the plant is completely air conditioned for the comfort of the 1200 employees and for production control of the various manufacturing processes.

Designed by the Sunshine engineering department, the plant has five floors in the center section and is 1200 ft in length. Sanitary conditions were designed into the building; for example, all the air is constantly filtered where production or office space is involved. The inside walls are faced with glazed tile, which is easy to clean, and the ceilings and columns are coated with a high gloss white enamel paint.

The ductwork that distributes air from the heating and conditioning units throughout the plant is fabricated entirely of aluminum. Fifty tons of sheet aluminum were used for the ducts.

How Well Water Is Used

A number of unusual engineering features were designed into the air conditioning, cooling and heating systems. Probably the most interesting is the way cool well water is used efficiently for cooling and air conditioning.

These systems have several basic functions:

1) Comfort air conditioning (general offices, cafeteria, etc.) — year 'round 72 to

Mr. Haley is Chief Architect and Construction Engineer, Sunshine Biscuits, Inc., Dayton, Ohio; Mr. Reilly is Manager, Air Conditioning Dept., Dravo Corp., Pittsburgh, and Mr. Stephen is Sales Engineer, Cleveland Office, Dravo Corp.

78 F, 50 percent relative humidity.

2) Air conditioning for manufacturing processes (production area of plant) — year 'round variation from 65 F at 40 percent RH to 82 F at 50 percent RH.

3) Cold storage air conditioning (raw materials for production). — year 'round 20, 35, 45, and 60 F.

4) Humidification for manufacturing processes — year 'round 80 F at 80 percent RH.

The 54 F well water is pumped from four 90 ft gravel-packed wells adjacent to the main building to a combined pump house-filter plant located on the west end of the property. Here two iron removal units reduce the iron content of the well water to 0.3 ppm. The process consists of spraying the well water over finely ground anthracite coal at the top of two vertical concrete filter tanks 19 ft in diameter and 11 ft high. After the water has passed through the filter by gravity, it is stored in a 70,000 gal concrete tank under the filter plant. The iron content of the water is high, and without iron removal the water would be unusable in the cooling coils and condensers.

Three centrifugal booster pumps, with rated capacities of 950, 1150 and 1350 gpm, then force the water into the well water circulating system in the main building.

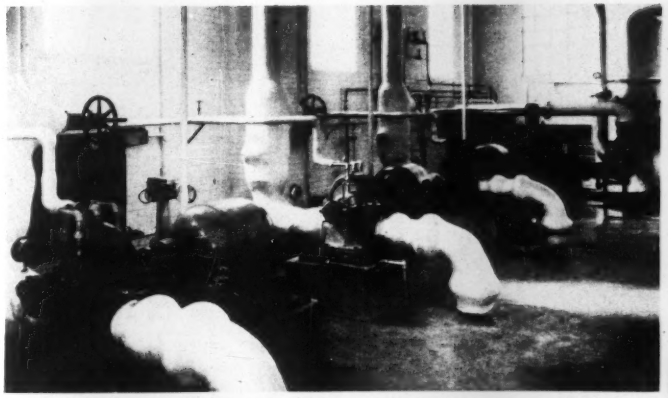
The booster pumps are controlled by a pressure actuated control to start and stop the pumps in sequence to simulate the effect of a standpipe and to give volume control as the demands for water change.

The pumps are primed continually and automatically, using electrode type controls with the vacuum being formed by a vacuum pump with a water-pressure ejector operated as a standby.

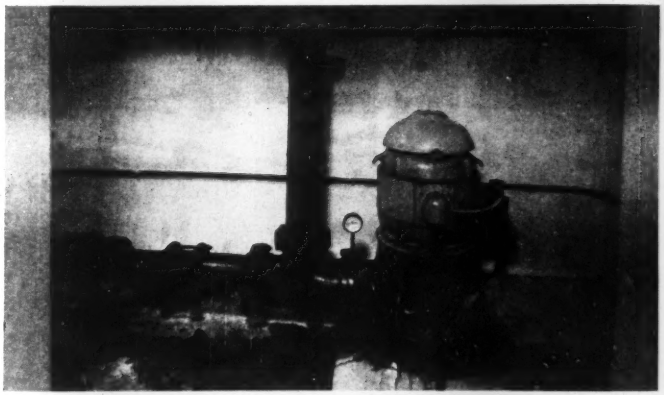
About 3000 gpm of well water flows through the many miles of piping in the well water circulating conditioning system. The treated well water, without further refrigeration, is used as the cooling agent for most of the comfort air conditioned spaces — a load of 700 tons of refrigeration.

Also Is Used for Condensing

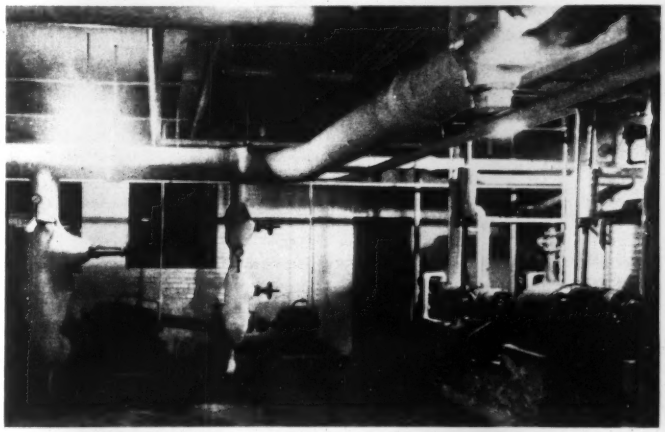
In addition to serving as the direct cooling agent in the comfort air conditioning systems, the well water has other uses. In the basement of the main building there is a 30,000 gal



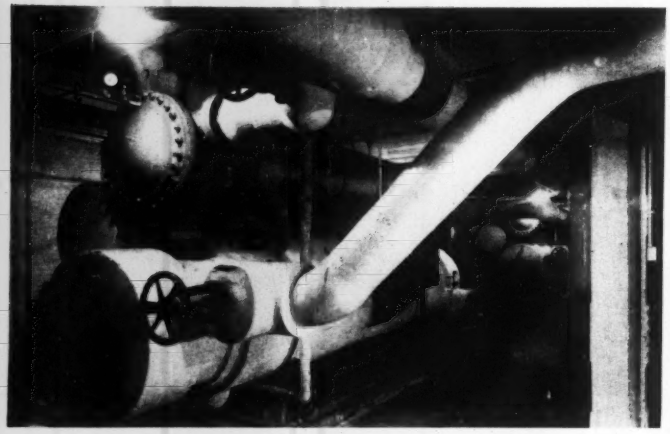
THE BOOSTER PUMPS for the well water system operate in seven different pumping cycles, separately or in combination



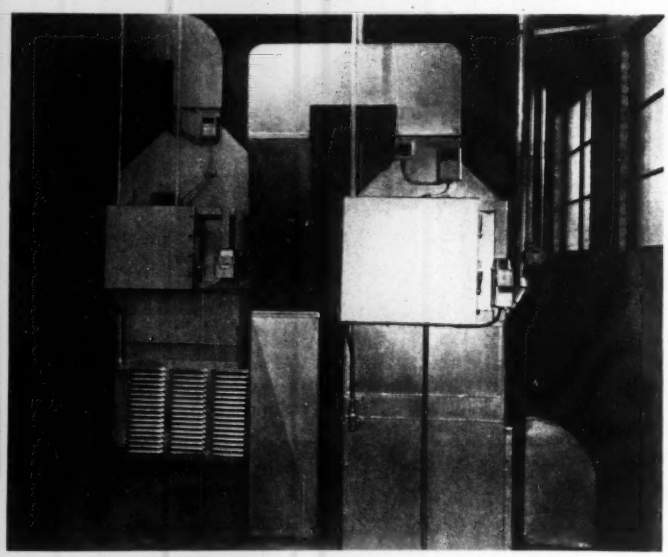
ONE OF FOUR PUMPS that take 54 deg water from 90 ft gravel-packed wells. Each pump is in a small room in the basement.



ONE OF THE PUMPS which supply the two main condensers with well water from the reservoir is at the left. Next to it is the pump that supplies auxiliary condensers with well water. On right is an air compressor



EACH OF THE TWO main water chillers cools ethylene glycol brine from 38 to 30 F. "Freon 11" is the refrigerant



HEATER IN FOREGROUND supplies hot air through duct to a basement liquid ingredient storage room that must be kept at a temperature of 100 F. Air is returned from the room to the heater through duct at right. Heater in the background takes care of space heating requirements in basement and first floor shipping departments, and the truck dock

concrete reservoir which supplies the necessary water for the condensers in the main and auxiliary water chillers. This reservoir is supplied from the well water return line by pneumatically operated valves actuated by two float level controls in the reservoir. Between the reservoir and the return well water line there is a bypass set to bleed 100 gpm from the well water line so that at least one of the booster pumps will be in continuous operation. This insures filling the condenser water reservoir at such times as the coil cooling requirements might be low. Conversely, a high level overflow in the reservoir allows drainage to the sewer when the condenser water requirements are less than what is needed for the well water cooling coils.

Two 350 Ton Compressors

The two 350 ton compressors each cool 865 gpm of ethylene glycol brine from 38 to 30 F. The compressors are used in conjunction with the cooling cycle for the ethylene glycol brine used in the chilled water system. The two condensers are supplied with well water from the 30,000 gal reservoir by two 1100 gpm pumps delivering against a 25 ft head and driven by 10 hp motors. The well water is also used for cooling in the auxiliary condensers for the cold storage room air coolers and is circulated by a 50 gpm pump.

"Freon-11" is employed as the refrigerant in the main chillers. The 300 hp synchronous compressor motors are equipped with speed increaser gears. Three 1000 gpm pumps driven by 30 hp motors supply the chilled brine piping system against a 95 ft head. All chilled brine piping is insulated with ice water thick cork and the brine cooling units are insulated with 2 in. cork with an asbestos cement finish.

The well water stored in the 70,000 gal reservoir under the pump-filter plant is also used as a standby water supply for the fire pump which is connected to the standpipe and sprinkler system. In order to guarantee an available water supply for the automatic fire pump, the booster pump suction line extends down into the reservoir to the 28,000 gal level. This leaves the balance of 42,000 gal of well water available for immediate use in case of a fire. The controls are so arranged that the booster pumps are automatically de-energized when the fire pump starts operating, giving further assurance of additional water in the reservoir in case of an emergency. The fire pump is driven by a 75 hp motor and is rated at 1000 gpm against a 230 ft head.

Lake on Roof Reduces Temperature

Another important function of this well water is as a cooling agent on the flat roof of the main building. This "lake", about 3 in. in depth, has a storage capacity of some 225,000 gal. This method of evaporative cooling is particularly practical for reducing the temperature on the large roof area over the main building.

33 Direct Fired Space Heaters

The availability of natural gas gave the Sunshine Biscuits management an economical fuel for space and production heating. It was decided to use 33 direct fired warm air space heaters. Twenty-seven of them are equipped with combination burners so that conversion to oil in an emergency can be made with no delay. This permits the use of gas entirely for baking in event of temporary curtailment. The standby fuel oil is stored in a 20,000 gal tank outdoors.

The various space design temperatures range from 20 to 140 F, not including the process heat required for baking and cooking.

Five Functions for Control Systems

A pneumatic system of automatic controls is used. In order to simplify and standardize the controls for the diverse requirements, it was decided that all control requirements could be analyzed into five functions which, in various combinations, would satisfy the needs of any system:

Function No. 1 provides for the control of outdoor and recirculating dampers through an electro-pneumatic switch connected to the fan motor, a gradual switch to position the dampers when the fan is in operation, and a safety thermostat to prevent freezing of water coils during freezing weather.

Function No. 2 provides a direct acting room thermostat which controls a reverse acting valve in the water supply to the well water cooling coils.

Function No. 3 provides a reverse acting room thermostat to control a three-way valve controlling the supply of chilled brine to the cooling coils.

Function No. 4 provides a reverse acting humidistat which, by working through a direct acting cumulator, operates a three-way valve to increase the flow of chilled brine through the cooling coil when dehumidification is required.

Function No. 5 provides a reverse acting gas valve or the electro-pneumatic switch on a space heater to provide reheat when reheat is necessary due to humidity control requirements.

The general offices, which occupy 13,200 sq ft of the first floor, are kept at 78 F in the summer and 72 F in the winter at not to exceed 50 percent relative humidity. The equipment for heating and air conditioning this office area is in a basement mechanical room. A 12,000 cfm fan discharges conditioned or heated air into a system of ducts concealed behind acoustical tile. The air is then distributed into the offices through ceiling diffusers.

A direct fired heater furnishes the necessary high temperature space heating for each of the three storage rooms in the basement of the building. Temperatures of 100, 115 and 120 F are required in each room to keep such items as syrups, lard and other ingredients fluid so that they can be pumped through piping to various manufacturing areas. One space heater, operating on 100 percent recirculated air, maintains the desired temperature for the ingredients stored in each room.

On the second floor there are three rooms for drying starch trays and each of these rooms is kept at 140 F

FILTERED, CONDITIONED AIR distributed through this ductwork keeps the dough cutting room at a constant desired temperature. Return air is pulled through wall opening in mechanical equipment room

THE ROOMS FOR DRYING starch trays are supplied with hot air by individual heaters; a temperature of 140 F is maintained. Hot air is discharged at high velocity through duct openings at floor level and returned to the heater through centerline overhead duct

KANSAS CITY PLANT of Sunshine Biscuits, Inc., has nearly 18½ acres of floor space, is one of the most modern of its type in the world

by individual direct fired heaters, each having a capacity of 400,000 Btu per hr. Air is discharged into the rooms at high velocity through duct openings at floor level. A return air duct to the heaters runs overhead on the centerline of each room.

Another large basement storage room is kept at 60 F by four air cooling units discharging into ductwork. Cellophane storage occupying about 2800 sq ft is constantly kept at 70 F and 35 percent relative humidity by two individual ceiling mounted air cooling units equipped with steam reheaters to control the humidity. Refrigerant is supplied to these units by a separate direct expansion unit with a 7½ hp motor.

Essentially, the comfort air conditioning equipment consists of air filters, well or chilled water coil banks, fan and motor. This equipment is encased in a sheet metal housing within each mechanical room. In each room, there is also a direct fired space heater.

Several Advantages of the Scheme

There are several advantages in using the direct fired space heaters in this plant. The problem of carrying a large stock of replacement spare parts is simplified, as all the heaters are of the same design and manufacture. Thus, by standardizing, the annual expense for maintenance is reduced. The heaters also give the advantage of a de-centralized system, reducing the risk of a major breakdown. This type of heating system confines any maintenance to a limited area, thus assuring continuous production. Another advantage is that seasonal process manufacturing can be accomplished by using only a selected number of the heaters installed, if desired. This can result in a substantial saving in operating expense because the input fuel requirement is reduced directly with the load requirement, there being practically no distribution or standby losses.

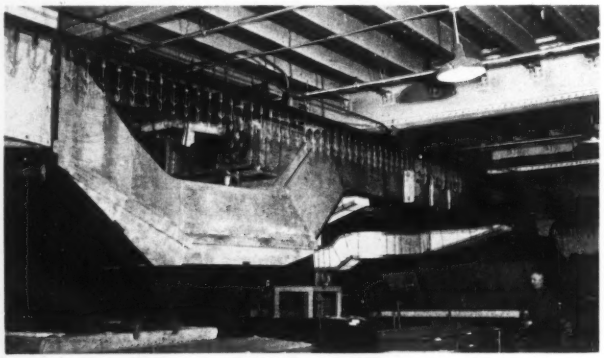
Several of the space heaters were designed into the air conditioning system as an integral part of it. In such cases, the standard internal fans of the heaters were removed because the air conditioning system fans furnish the necessary air. One exception to this is in the cafeteria, where a 12,000 cfm fan within the heater is used to move the cooled and heated air in the duct system.

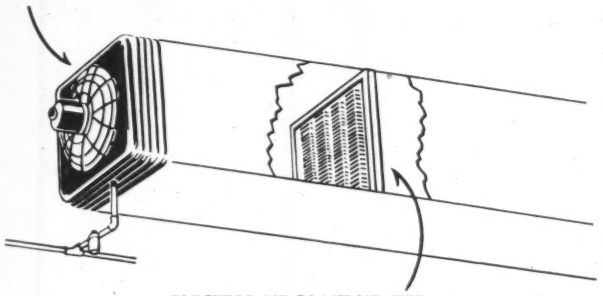
Each heater has a stainless steel combustion chamber for rapid transfer of heat to the air being heated and to eliminate the problem of corrosion from moisture-laden air passing over the outside heating surface of the combustion chamber during the cooling cycle.

Electric Duct Heaters Boost Drying Temperature

How to raise the temperature of drying air in an elaborate duct system posed a serious problem in a large plant manufacturing galvanized products. Installed steam coil heaters were found to be inadequate for heating air to 350 F, which was required to heat the parts to 250-275 F.

A quick solution was found in 20 kw electric air blast heaters operating on 230 volts. Standard heaters of the exact size to fit the ducts were inserted, and the required temperature was easily reached. (Illustrations courtesy Edwin L. Wiegand Co.)





A QUICK SOLUTION to the problem of increasing air temperature for drying was the use of electric air blast heaters to supplement the steam heaters

Confer on Condensation Control in Buildings

E. R. McLaughlin, Associate Professor of Engineering Research, The Pennsylvania State College, summarizes BRAB conference on condensation problems and their solution

CONDENSATION CONTROL in buildings was the subject of a "correlation conference" conducted by the Building Research Advisory Board of the National Research Council, at the National Academy of Sciences in Washington, D. C. recently. Contractors, builders, architects, dealers, technologists, and trade association representatives discussed various phases of the condensation problem as it exists today.

Those who had witnessed the effects of condensation on buildings reported the problem as they saw it. An architect discussed the features of architecture relating to water, water vapor and its control. A painting contractor pointed out the effects of excessive water accumulation behind paint films. Ice dams and leaking gutters were charged with a large portion of paint damage. A dealer and a builder discussed unfavorable situations arising from condensation which were referred to them for action by irate clients.

Water Vapor Transfer a Complex Subject

In a discussion of the technological aspects of the problem, test equipment was described and the results of numerous tests were summarized to show that the uncontrolled flow of water vapor from a room into exterior walls in winter can be detrimental to the performance of a building structure.

A rather thorough explanation of the mechanism of water vapor and water movement through permeable and porous substances helped to explain some of the inconsistencies between simplified laboratory tests and conditions observed in the field. This explanation also pointed out the complex relationship between several different modes of water vapor transfer. Vapor pressure difference alone is insufficient to determine how a material will perform. Sorption and spreading pressures of the sorbed layers undoubtedly have a marked influence which may or may not assist the flow by vapor pressure difference.

A lot is expected of an exterior paint coating, it was pointed out. In addition to protection from the weather it may be subjected to the pressure of condensed water behind it. Osmosis is credited with creating the pressure of approximately 200 lb per sq in. which is required to break the adhesion between paint and siding. Temperature change, volume change, and re-evaporation are questionable factors.

The correction of some of the difficulties experienced with exterior paint films lies in the application of a good vapor barrier on the warm side of walls and possibly increased permeance of the exterior paint film or other means of vapor release to the outside air. The test house for determining blister resistance was described as an important part of this study.

To illustrate the confusion which exists in terminology and methods, seven different units for expressing permeance and 11 different pieces of equipment for determining it were reported. It is significant that there is no reliable method for accelerated testing of the effects of moisture on paints.

As an economy measure it was suggested that paint be applied to a structure according to the severity of the exposure — four mils on the south, two mils on the north, etc. — for a total amount of paint which would equal 88/100 coat in the conventional two coat system. In this way a saving in material and labor could be realized and the protection would be adequate for each exposure.

Paints offer an excellent vapor barrier for application to the interior surfaces of existing walls, it was stated.

Building Is a "Glorified Package"

The concept of a building as a "glorified package" was expressed at the session on paper and foil films. Since these materials are used as vapor barriers, care in installation was emphasized. Openings at the top and bottom of an insulation blanket permit air convection, which in effect short-circuits the insulation and barrier and impairs their effectiveness. Holes the size of a lead pencil through a barrier will seriously damage some barrier applications and the barrier designer should consider the practical problems of installation.

The value of marking papers to identify them as vapor barriers or permeable paper is two-fold. Such markings would enable informed builders to place the paper correctly and would arouse the curiosity of the uninitiated and thereby assist in the dissemination of the vapor transfer knowledge so much needed.

The problems arising from moisture transfer into frame construction were attributed to today's tighter construction, which limits natural infiltration, and the frequent use of insulation without benefit of vapor control in some form. It was deemed the prerogative of an owner to have high inside humidity if he desires it. The building structure thus should be designed with this factor of comfort in mind. There are numerous instances where the use of a material is beyond the control of the manufacturer. Where difficulty occurs, the situation should be evaluated properly to avoid the same troubles in the future and relieve the manufacturer of unjust criticism.

In a consideration of future opportunities, the value of a building code based on performance rather than materials was emphasized. Current research on moisture control in insulated built-up roofs was mentioned and the need for additional research in this field was suggested. The development of permeable exterior paints and further knowledge of the path and mechanism of vapor release from walls seems desirable. More information is needed on the effects of humidity on health. Standardization of terminology and test units would go far in reducing the confusion and the difficulties of discussion. More realistic test methods were suggested. A resolution was proposed and accepted that the BRAB appoint a committee to study the transcript of this conference and provide some guidance in the future efforts along these lines.

Education on Vapor Is Needed

Educational opportunities for getting the technical facts into daily use are enormous and several examples of very effective literature and programs were mentioned. Advertising appears to be a means of accomplishing a two-fold purpose — the technical facts can be made attractive and the product is advocated in its proper role in the building trade. Concerted action between trade associations and other agencies seems very desirable. Another resolution was proposed and adopted that the BRAB committee also consider methods and means for assisting in this.

In his summary of the conference, T. S. Rogers, the conference chairman, pointed out that there remained certain areas of activity which had not been touched upon. Masonry walls were not discussed, and work is needed on this type of construction.

It was suggested that other trades be included in the educational program. Plumbers and electricians, by virtue of the sequence of construction work, can do much to avoid damaging insulation and vapor barriers if they are aware of these vital parts of the assembly. With the cooperation of all trades, the problem of vapor control can be solved.

Installing Prestressed Concrete Piping for Water System

HOWARD S. DEWEY describes briefly the water supply system for Groton, Conn., which includes 3½ miles of 20 in. prestressed concrete piping. Cast iron mains are also used, and cast iron piping is installed in the plant itself. Stainless steel perforated lines are employed in the filtration tanks, to avoid troubles from corrosion plugging up the perforations

THE PRESTRESSED PIPING was laid down in 16 ft lengths, using a wire sling and a power shovel

THE BOROUGH OF Groton, Conn., is an old town with new ideas. To prove it they can drink with pride from their new $2 million water system and filtration plant.

The plant, which is fed by three reservoirs having a total capacity of 250 million gal, has a design rating of 4 million gal per day net output, and consists of facilities for coagulation, sedimentation, rapid sand filtration, chlorination and corrosion correction with lime.

Four high lift pumps of 1600, 900, 700 and 500 gpm are normally used for pumping the plant output into the distribution system as required. Two distribution system standpipes hold some 3 million gal floating on the system at all times.

Three transmission mains carry the supply from the pumping station to the "grid" — a 16 in. cast iron main to the northerly end, a 10 in. cast iron main to the middle section, and a 20 in. prestressed reinforced concrete main to the southerly section. The distribution grid consists of some 40 miles of pipe ranging from ¾ to 20 in. in size. Approximately 1800 ¾ in. to 1 in. service taps to residence and commercial occupancies are connected to the system.

The prestressed pipes, laid in 16 ft lengths in the trench, have a special bell and spigot type joint sealed with a rubber gasket. In installation, a wire sling was adjusted around one section and lifted with a power shovel which, using the weight of the section, forces the joints in place. The rubber gasket, lubricated with vegetable soap for easy insertion, seals the joint.

Prestressed pipe consists of a watertight welded steel cylinder within which a dense core of concrete is placed by the centrifugating process. Both cylinder and core are wrapped helically with high tensile steel wire under a high and uniform tension. The structure is then mechanically coated with ¾ in. of rich cement mortar.

The lock joints maintained a 200 percent saving in water leakage over the guaranteed limits set for the contractor.

Prestressed concrete is an innovation developed in Europe and being further developed in this country. Prestressing involves essentially building into the structural members certain stresses opposite to those the members are intended to carry. Prestressed concrete is said to be virtually crackless, as when cracks do occur the stressing forces the lips of the crack together.

In the Groton plant itself, cast iron pipe is used. A 21 in. flanged cast iron line supplies the main filtration plant from one of the three reservoirs. The water goes to tanks where chemicals are introduced and the water is aerated. From this point it flows into coagulation tanks

through 16 in. cast iron piping. After sedimentation has taken place, it flows by gravity through a 20 in. line into the filtration tanks. It drops down through 6 ft of sand and various grades of gravel. From the bottom of the tank, lateral stainless steel 3½ in. perforated lines with a wall thickness of ⅛ in. drain it off into a clear water reservoir through a 24 in. cast iron pipe.

Stainless steel is used to reduce the corrosion that took place around the holes in the old piping installation, which plugged the perforations and seriously reduced the filter output.

From the clear water reservoirs the high lift pumps distribute the water to the main distribution prestressed and cast iron mains.

For cleaning the filters, a blow back process is used from a nearby stand tank. Water is allowed to flow back into the filters through a 20 in. hydraulically operated gate valve which taps into the normally used drain line above a hydraulically operated shut off valve. The hydraulic gate valves are operated with water pressure off the main pumps which feed the main distribution system, through ¾ in. copper tubing.

Provision for future expansion of the system has been made by providing duplicate filtration and piping systems. All piping imbedded in concrete foundations or underground has been placed and the ends blanked off to keep the piping clean and dry. Within a limited time the output can be increased without disruption of present production.

THE 16 FT LENGTHS have a lock joint fit, sealed with a rubber gasket

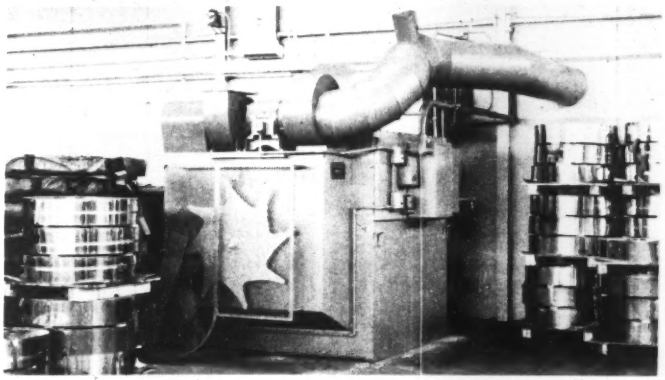
DEHUMIDIFIER SAVES STEEL WAREHOUSER $2000 A YEAR

WAREHOUSERS AND STORAGE supervisors in many industries wage a constant battle against the effects of moisture on finished products, new material, work in process.

Steel warehouses must oil and inspect their stocks frequently. The Kenilworth Steel Co., a large New Jersey finisher and warehouser, has eliminated several time-consuming handling steps and reduced costs by installing dehumidifying equipment. Savings in tangible items — oil, labor and inspection — are estimated at $2000 a year by R. T. Connelly, the plant manager.

Before the dehumidifying equipment was installed, Kenilworth inspected incoming steel for signs of rust and oiled or greased the steel before putting it in storage. During storage, the highly perishable stocks of steel were periodically inspected and oiled. Now the firm inspects and oils the steel only once — just before it is shipped — thanks to the relative humidity of 40 percent maintained in the storage area. [Photo courtesy Pittsburgh Lectrodryer Corp.]

SIMPLE INSTALLATION of a dehumidifier beside stockroom at Kenilworth Steel Co. prevents rust formation on steel stocks, saves the firm an estimated $2000 a year. Relative humidity is held to 40 percent, though walls and doors of the room are not sealed



Handling and Burning Oil Discussed at OHI Meeting

SOME OF THE HIGH-LIGHTS of the engineering information given at the recent annual convention of the Oil-Heat Institute of America, held in Philadelphia, are reported here

THE 29TH ANNUAL CONVENTION of the Oil-Heat Institute of America, Inc., held recently at Philadelphia in conjunction with the oil heat exposition, featured sessions of interest to the OHI's different divisions.

At the annual business meeting the officers were re-elected for another year, with T. A. Crawford, Timken Silent Automatic Div., Timken-Detroit Axle Co., continuing as president; and P. K. Addams, Fitzgibbons Boiler Co., and H. H. Wilkinson, Herco Oil Burner Corp., as vice presidents.

At the various division sessions, the subjects of selling, engineering and fuel oil specifications were given considerable attention. Only those papers of particular interest to HPAC's readers are reported on here.

Storing and Handling Heavy Fuel Oil

The engineering session was conducted by L. N. Hunter, of the National Radiator Co., chairman of the OHI engineering committee.

In his paper on storage and handling of heavy fuel oil, Ernest C. Webb, of the Iron Fireman Mfg. Co., discussed the pour point and viscosity of oils, primarily in the No. 5 and No. 6 grades, and explained preheating requirements and the problems in starting up after an extended shutdown period during cold weather.

In concluding his discussion, Mr. Webb said that "far too many heavy fuel oil installations have been made in which the owner has not known at the time of purchase just what performance could be expected from the equipment when using different grades of oil.

"Many have thought that they were getting a heavy No. 6 oil job and assumed that provisions would be incorporated for readily starting after a cold shutdown when actually all they had was an installation suitable for No. 5 oil with a *limited viscosity range* and a *limited pour point*.

"Such instances are very unhealthy for the heavy fuel oil industry and every effort should be made to reduce them to an absolute minimum," he said.

To avoid these misunderstandings and *to provide a correct basis for cost comparisons*, he recommended that the purchaser of a heavy fuel oil handling system clearly state in his specifications:

1) The Commercial Standard grade of oil that is to be handled.

2) The pour point limitations if No. 5 oil is specified.

3) The viscosity limitations if other than those specified for the Commercial Standard grades.

4) Whether or not facilities shall be provided for conveniently starting up the system after a prolonged shutdown in cold weather.

Asks for New Fuel Oil Specs

J. Verne Resek, of the Cleaver-Brooks Co., made a strong plea for new specifications for fuel oil for commercial and industrial burners, since the present specifications for such oils "cannot be used to define the fuel oil to be used with a particular type of burner". He presented suggested new specifications and pointed out that if the user of an oil burner can be assured that he can purchase oil by number and get what he needs for his burner, great good will result to the distributor of fuel oil, the manufacturer of the burner, and the oil burner user.

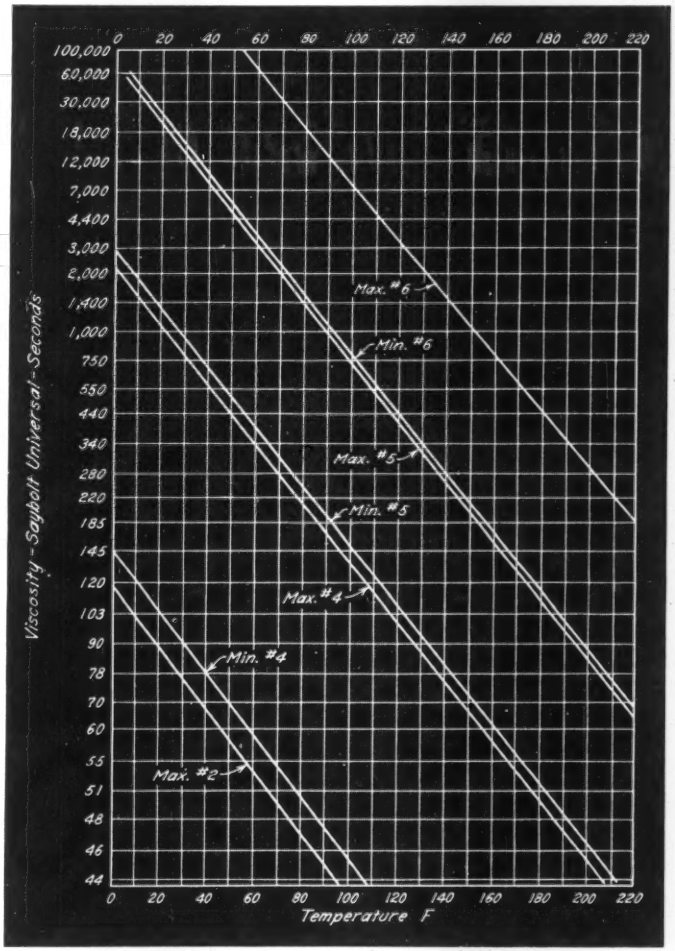
In the discussion which followed, oil burner manufacturers seemed to be in favor of Mr. Resek's proposals but representatives of the fuel oil producers brought up many difficulties involved in such procedure. In a later discussion in another session, a representative of one of the refiners pointed out that the oil companies are striving to get all the high priced gasolines and distillates possible out of crude, with residual oils becoming a smaller and smaller percentage. As a result, characteristics of heavy fuel oils are changing and, admittedly, are affecting oil burning equipment. He doubted if exact specifications could be attained in the heavy oils and explained that it was also a matter of economics. However, he assured the audience that there would be an ample supply of residual oils and that adverse changes can be minimized by the refiner if it is profitable to do so.

Start-Stop Characteristics

E. B. Delgass, K. J. Whittet and H. G. Murray, of the Socony-Vacuum Laboratories, spoke on improving the start-stop characteristics of high pressure burners. They described the smoke and soot generating tenden-

cies of high pressure gun type oil burners and presented principles for preventing smoke during starting and stopping which should materially improve combustion efficiency. They said that tests have shown that starting and stopping smoke is more conducive to soot deposition than is smoke produced during equilibrium.

The annual banquet was a big event of the meeting, with A. T. Atwill, a past president of OHI, acting as toastmaster. The "Old Timers" turned out some 100 strong for their usual dinner and jamboree.



APPROXIMATE TEMPERATURE-VISCOSITY characteristics for Commercial Standard (12-48) fuel oils. The temperature of the oil in the storage tank must be above the pour point of the oil to permit proper flow to the point of removal from the tank. It is also necessary to maintain a sufficiently low viscosity of the oil at the point of removal from the tank to permit a free flow of oil into the suction line. Viscosities of less than 5000 SSU are necessary and 3000 SSU is usually preferred as an upper limit at this point, according to Mr. Webb. For satisfactory pumping of the oil from the storage tank to the burner the viscosity should not exceed 5000 SSU as a maximum limit and a value below 3000 is preferred. The maximum viscosity at which satisfactory ignition and atomization may be obtained will vary with the different burners and under different operating conditions. However, most burners using automatic ignition will require oil viscosities below 1000 SSU and many will give best results at viscosities below 500 SSU

Next Meeting in '53, Exposition in '54

It was announced that the 30th annual convention is to be held in Chicago in April 1953, and that the next exposition (which is on an every other year basis) is scheduled for Philadelphia in April 1954.

TECHNOLOGY IS WAY TO COMBAT POLLUTION

A DU PONT COMPANY vice president told the National Air Pollution Symposium last month that industry is making greater progress in combating air and water pollution by attacking the problem through its laboratories than can ever be accomplished by "legislation or regulation."

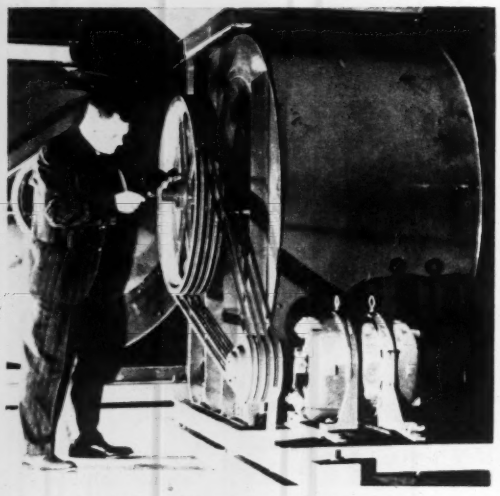
"It seems clear to me that our greatest promise in abating pollution lies in giving full reign to advancing technology," said Henry B. du Pont, a vice president and member of the board of directors of the company.

While conceding that pollution control laws "are working satisfactorily where they have been well administered and where there has been real cooperation between industry and the control agencies," Mr. du Pont said that laws "cannot bring clean air and water any more than safety regulations alone can prohibit accidents.

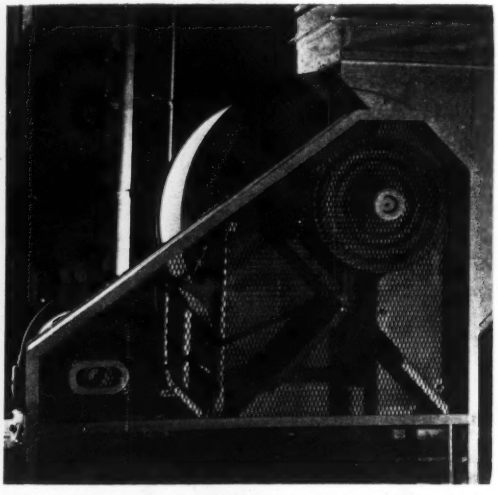
"To a certain extent," he pointed out, "pollution has been a part of the price we have paid for an industrialized society capable of supplying us with a high and ever-rising standard of living.

"The peasant villages of central Europe are, perhaps, free of smog, just as they are free of bathtubs, Chevrolets, and electric refrigerators," Mr. du Pont said. "They are not as free of odors as some might expect, and they are certainly not free of disease, dirt and poverty.

"So, in a way we have paid a penalty for the kind of civilization we have built. But we do not agree that it is a permanent price we have to pay. We know that with the will to correct the situation and with proper effort and sufficient time, pollution can for all practical purposes be eliminated."



IT IS DIFFICULT TO PREDETERMINE exact speeds of ventilating and air conditioning fans. With variable speed sheaves and a tachometer, it is possible to balance the system before drive guards are installed and the equipment put in service



BECAUSE OF CONVENIENCE and easy installation, the motor is usually mounted on the floor as close to the fan as possible. This results in a long center distance which is not detrimental to good drive operation but requires more frequent maintenance check-ups

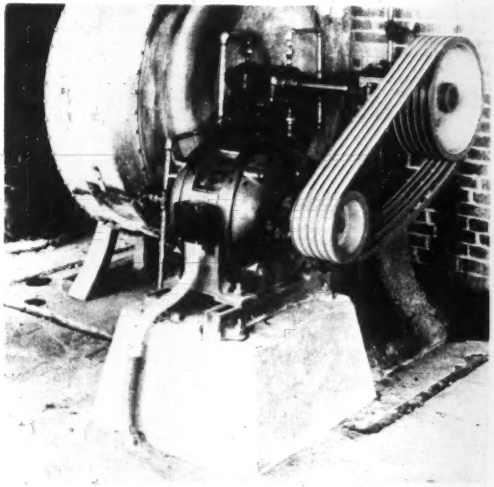
The Use and Maintenance of V-Belt Drives

There are many excellent reasons for the wide use of V-belt drives on air conditioning, ventilating and heating installations, and these are summarized here by Frank H. Rumble, Texrope Drive Dept., Allis-Chalmers Mfg. Co., who outlines also methods of making speed changes, use of superrated belts, and the importance of maintenance. Fan drives may require more careful maintenance than do drives with even heavier load factors because they usually are long center drives

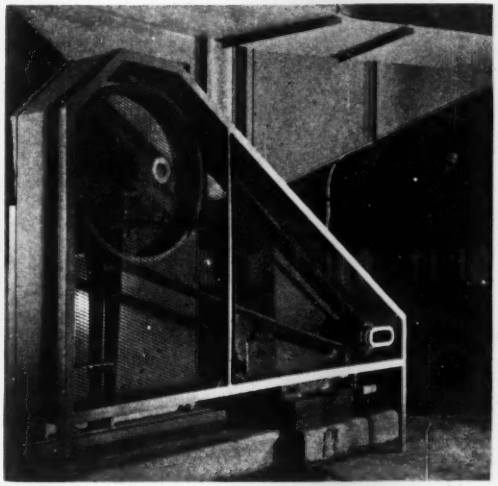
IT IS ESTIMATED that of the thousands of fans, blowers, pumps and compressors of all sizes installed each year for heating, ventilating and air conditioning, more than 90 percent are driven through V-belt drives.

There are a number of excellent reasons why the V-belt drive—one belt or in multiple—is used on the majority of these installations. Perhaps one of the more important is the ease of obtaining the exact speed required in the driven machine from a standard speed motor by use of the proper sizes of driver and driven sheaves. Ratios from 1 to 1 up to 10 to 1, if necessary, can almost always be selected from stock sheaves and belts carried in manufacturers' factory or field warehouses, without the necessity of having special sheaves or belts made to order. Because of this inherent capacity to operate efficiently throughout a wide range of ratios, and the availability of the necessary component parts, the V-belt drive is flexible, adaptable and economical.

Among other advantages of the V-belt drive is its capacity to operate



IT IS POSSIBLE TO construct a short center fan drive, but only if a substantial foundation or structure is built so that the motor can be mounted near the driven sheave. Time and expense often do not permit this, a long center drive often being cheaper



INSPECTION AT REGULAR INTERVALS of V-belt drives on fans — even after the break-in period — is a good idea. Any irregularities are thus easily remedied. Alert preventive maintenance is largely responsible for the long service records on V-belt fan drives

on extremely short centers, which makes it a compact, space-saving method of power transmission. It is quiet in operation, shock absorbing, and actually acts as a vibration dampener on many installations. The V-belt drive is clean—the belts need no lubrication—and is quick and easy to install. The drive is reliable; replacement parts are low in price and quickly available if needed.

Provides for Speed Changes

Still another advantage of the V-belt drive, and one which is increasing in importance, is the opportunity of providing economical mechanical speed changes through the use of a variable pitch diameter sheave. Such a sheave is usually mounted on the motor, which in turn is mounted on a special base to provide easy and quick changes in center distance as the pitch diameter of the sheave is made larger or smaller.

A modern trend on installations which require a change in speed seasonally or occasionally is to use a variable pitch diameter sheave which does not need to be replaced but only must be adjusted in order to produce as great or little a speed change as desired.

Many manufacturers and contractors have found it advantageous to equip their fans with variable speed drives even though no great changes in speed are desired or required after the installation is complete. This is because some contracts (particularly where government buildings are concerned) stipulate that no piece of equipment may be changed or replaced once it has been installed; in many cases this applies to sheaves of the V-belt drives. It is not always possible to predetermine the exact speed at which fans must be driven in order to achieve the results desired. If the V-belt drive is equipped with a variable sheave, however, it is a simple matter to change the speed and balance the heating, cooling or ventilating system.

The majority of the variable speed V-belt drives used on air conditioning equipment are of the stationary control type, since the speed changes needed are seasonal or not so frequent that they cannot be made manually when the drive is stationary. In some instances, however, it is desirable to change the speed while the drive is in motion and variable pitch diameter sheaves of this type are available. It is even possible to control speed changes automatically on installations where exact temperature and humidity must be maintained or, perhaps, quickly changed from one extreme to the other.

Use of Super-Rated or High Capacity Belts

As has been mentioned, an important advantage and feature of the V-belt drive is that it is space-saving and compact. The drive can be made even more compact and will occupy less room by using super-rated or high capacity V-belts. This type, which is more costly to manufacture and which sells at a premium, is built with stronger cords and materials and is rated to carry 40 percent more horsepower capacity than the same size of standard belt.

On installations where a number of standard V-belts would be required, it is often possible, through the use of the super-rated belts, to reduce the total quantity of belts needed on the drive. Though the cost per belt is higher, fewer are required—and also the necessary sheaves have fewer grooves and consequently are lower in price. This may result not only in a lower cost drive but one which is narrower and thus does not take up as much space.

Maintenance of V-Belt Drives

Proper maintenance, though simple, is important to long life and

PERFECT ALIGNMENT of sheaves contributes to the long life and silent operation of V-belt fan drives.

economy of the drive. With reasonable check-up periods and proper care, belts can often be made to last from 10 to 15 years or longer.

It is felt that a little explanation of the particular problems encountered with use of V-belt drives on air conditioning, heating and ventilating equipment will be of value to the manufacturers and installers of such machinery as well as to those who are entrusted with the actual maintenance work.

The load factor in air conditioning drives is relatively low. On fans, blowers, compressors and circulation pumps there are no shock loads and speed is usually constant over long periods of time. However, in spite of this easy service, air conditioning drives may require more careful maintenance than many drives which have heavier load factors. Particularly is this true of fan drives. The reason is that they usually are long center drives.

In most cases the diameter of a fan is large, while the sheaves used are small in comparison. It is possible and sometimes advisable to build a special foundation or structure to support the motor so as to bring it close to the driven sheave. However, it is often cheaper and more convenient to use a long center drive with the motor mounted on the floor. So, while the ideal center distance of a V-belt drive is between one and one and one-half times the diameter of the larger sheave, fan drives usually have center distances many times this figure.

Modern V-belts do not have a high percentage of stretch. The small percentage of stretch per inch is the same in either long or short belts. However, in a long belt there are many more inches to stretch, so that the *amount* of stretch is more apparent on long belts. Consequently, more care and attention must be given to the problem of belt stretch on long center drives.

A sliding motor base will provide the take-up needed to correct for belt stretch. The stretch is greatest on new belts during the first couple of weeks of the break-in period. Belts should be checked several times during the first two weeks of service. After that, the drive should be inspected occasionally—but it is probable that further adjustment will be required only if the speed of the fan is not changed seasonally.

When seasonal or occasional speed changes are made, adjustment for belt stretch is automatically made when proper tension is put on the belts after the speed change has been completed. If no seasonal speed changes are made, belts should be checked regularly for sag, say every three months. If one belt needs to be replaced, because of excessive wear or accident, all belts on the drive should be replaced with a matched set to insure uniform pull by all belts.

Another precaution that is important on all V-belt drives—but perhaps more so on fan drives—is to make sure that the sheaves are always in alignment and the driver and driven sheaves are exactly parallel. If this condition is not true, undue wear on belts and sheaves will shorten the life of the drive.

Such a situation is bad enough on the average drive, but is worse on a fan drive because of the noise element. Belts out of line may set up a vibration, or uneven wear on fan bearings may in time cause them to become noisy. Endless V-belts in perfect alignment run silently and uniformly and contribute to the suppression of noise—which is an important factor in heating, ventilating and air conditioning systems.

CONVECTORS HEAT SCHOOL TOILET ROOMS

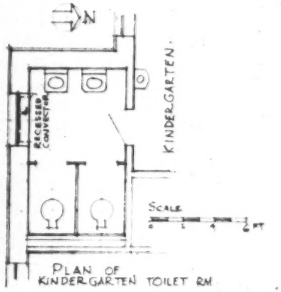
A NEW TECHNIQUE in school building heating is exemplified in the Herbert Hoover school, Tonawanda, N. Y.

There is a toilet room adjacent to each of 12 lower grade classrooms. Within each 6 ft by 10 ft area, separated by a door from the classroom, there are two midget size toilets and lavatories.

To conserve space, to eliminate the possibility of tampering with valves, and to assure safety for the children, wall recesses were designed. Cast iron convectors were placed in each setback and were sheathed by a conventional perforated metal enclosure. Thus, each toilet room is heated without sacrifice of limited floor space, and without providing temptation to busy fingers.

All classrooms, the gym, offices and auditorium in the $2 million school are heated by 279 cast iron convectors. The steam distribution is controlled by a pneumatic control system. Classroom installation of the convectors was made beneath windows, as well as along some interior walls. These heating units distribute warmed air through openings in the tops of their enclosures.

The architects were Kidd & Kidd, Beeman & Candee were the engineers, and the heating contractor was Joseph Davis, Inc. [Sketch courtesy the National Radiator Co.]



RECESSED CONVECTORS in toilet rooms for lower grade classrooms at Herbert Hoover school save floor space, don't invite tampering

Letter Signed by One Party Is Sometimes a Contract

A CLEVERLY WORDED letter, signed by only one party, can prove as strong as a contract. The actual case that follows affords a good example of such a letter and a demonstration of its legality.

The Anonymous Mfg. Corp. retained the Tubular Supply Co. (the names are fictitious) to act as its sole distributing agent for piping and other equipment in a certain area of a state at a fixed commission on all orders. At least, that's what the Tubular firm contended when it sued Anonymous for unpaid compensation, basing the claim on a verbal agreement and on a letter that it wrote to the manufacturer.

In the original suit, Tubular asked the judge to declare the rights of both parties. Neither party was satisfied with his judgment and both appealed. Reviewing the evidence in the case, the district court of appeal quoted from the letter to the Anonymous Mfg. Corp. upon which the Tubular Supply Co. leaned so heavily:

". . . Please enter attached order for materials for our stock . . .

"In accordance with the terms of your verbal agreement, we are to act as your sole distributor . . . and will receive a commission of 20 percent on all orders, whether placed through us or sent direct to you, with the exception of" the Hesperid Equipment Co., unless that company "specifically wishes to place the order with us along with other materials; in which case we reserve the right to do business with them on an equal basis with yourselves. . ."

The letter went on to stipulate that the agreement could be terminated at any time upon 30 days' written notice from either party. Furthermore, the manufacturer was to let the supply company know by return mail if the terms of the letter did not meet with the manufacturer's approval.

Letter Was Not Signed by Recipient

This letter was signed by the Tubular Supply Co. but was never signed by its recipient, the Anonymous Mfg. Corp. Such signature or countersignature was unnecessary, said Tubular, because Anonymous by accepting the *order* accepted the *letter* and its *terms*, to which silence gave assent. Definitely, Tubular contended, the *letter was the contract*, binding upon both parties.

Evidencing a spirit of fairness was a clause in the letter giving Anonymous the right to terminate "if in your opinion we are not sufficiently covering the territory to increase the volume of business." In such case, any stock which Tubular might have on hand would be returned to the manufacturing concern at the current resale price less Tubular's discount.

Following receipt of this letter by Anonymous, Tubular sold that corporation's equipment and products in the area designated and both parties performed according to the letter's terms. Anonymous accounted to Tubular for commissions on Tubular's sales volume, and reduced the commission rate on sales that the manufacturer made direct. Tubular accepted this arrangement without demur.

However, Tubular did protest vigorously when Anonymous finally refused to pay any further commission at all on direct sales. This occurred on September 4, some three years after the arrangement began. In its letter of refusal, Anonymous offered to buy back from Tubular all equipment "heretofore . . . sold to you by us, and now in your possession," except all such parts "as are in a damaged condition and . . . as are now obsolete by reason of improved and different designs." Anonymous reserved the right to determine what parts might be obsolete. Delivery was demanded at the Anonymous plant by September 18, Tubular to bear the expense of delivery and retransportation of rejected equipment. No formal notice of the contract's cancellation was ever given to Tubular Supply by Anonymous Mfg.

Tubular then asked the court for declaratory relief, and was awarded a judgment against Anonymous for some $8000, which represented the direct sale 20 percent commissions remaining unpaid, after deducting an admitted offset. Tubular figured a larger amount.

What the Appeal Court Decided

When both parties appealed, the district court of appeal sustained this finding and held that, among other things:

1) Receipt and acceptance, by *one* party, of a paper signed by the other only, and purporting to embody all the terms of a contract between them, binds the *acceptor* (the party receiving the paper) as well as the signer.

2) Acceptance of smaller installments of commissions for selling the manufacturer's products than were due under contract, bound the supply company as to those installments but did not modify the contract as to future payments.

3) The contract ended when Anonymous demanded re-delivery — not later, as Tubular contended. Therefore, the sum awarded Tubular was fully sufficient.

In addition to picturing yourself as the *sender* of such a letter, it is to your advantage to be on guard as a possible *recipient* of a similar document. The principle involved is not necessarily confined to dealer-manufacturer relationships, but might just as well apply to the relationship between a contractor and either his client or his supplier.

If the relationship is undesired, an *immediate* refusal is imperative; if the terms are acceptable for a period and then become undesirable, a prompt cancellation is in order. The moral is to regard such letters as contracts at all times and to treat them accordingly.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Reader's Query About Perimeter Heating Answered

A QUESTION ABOUT PERIMETER heating was asked by an engineer in the May HPAC. The installation is for a one floor building of rather large size, using clay pipe ducts for distributing the warm air from a heater room in the center of the building. The structural engineers asked if there would be any possibility of the heat from the pipe runs drying out the soil to the extent that there would be any settling of the pipe or of the floor slab itself.

Comment in answer to this question follows.

WILL FLOOR HEAT CAUSE SLAB TO SETTLE?

THIS IS IN REPLY to the question of the month, "Will Heat Dry Out Soil and Cause Pipe or Slab to Settle?" in the case of warm air perimeter heating, asked by a reader in the May HPAC.

Undoubtedly this question warrants some consideration, even though it does not seem possible that under normal conditions there would be sufficient heat provided to cause the warm air perimeter heating ducts to settle and thus cause the floor slab to settle also — any more than any type of heating system would, utilizing all or a part of the slab heated. It would seem that for this condition to occur, the soil below the recommended wash gravel fill would have to be loose and full of voids. Settling would probably take place regardless of whether the slab was heated or not. Even if there was a possibility of the heat in the feeder and perimeter ducts causing the subsoil to collapse, I doubt if such would occur in normal construction with the major portion of the load of the structure bearing on the foundation wall which is separate from the slab itself.

If a large amount of fill is used in a building of rather large size, as is sometimes necessary to prevent the cost from being excessive for washed gravel fill, then the common practice of tamping the fill thoroughly should be followed. In many cases of this type, the fill is thoroughly soaked or "wetted down" to remove all the voids and thus eliminate as far as possible settling later. This procedure of tamping the fill or "wetting it down" should be followed, however, regardless of the type of heating that is employed in the structure or in the slab, allowing sufficient time for the fill to dry out before the slab is poured.

Another important factor in connection with the settling of the slab or the clay pipe heating ducts is the drainage away from the structure proper. Naturally, good drainage must be provided to insure against these settling difficulties and others as well. Good drainage is not only desirable from the standpoint of preventing the slab from settling but also from the important factor of minimizing excessive heat loss from the heated slab. If the soil around the perimeter of the structure and below the structure becomes wet, a greater amount of heat is going to be transmitted away from the slab. In this same connection, wet soil below the slab and around the perimeter may prove to make the edge insulation totally ineffective if it is not of the type that positively does not absorb moisture. All in all, it is most important from all considerations to select a dry site, provide good drainage, provide proper treatment of the ground and fill under the slab, and insulate the edge of the slab adequately whether the slab is heated or not.

Complete instructions for proper slab and ground treatment prior to the installation of the perimeter heating ducts is given in Manual No. 4, "Warm Air Perimeter Heating", recently published by the National Warm Air Heating and Air Conditioning Association, 145 Public Sq., Cleveland 14. This second edition of Manual No. 4 has been based upon two years of exhaustive research investigations at the University of Illinois at the Floor Slab Laboratory and in Warm Air Heating Research Residence No. 3, and upon a comprehensive study of actual field conditions by the field engineer and the mobile testing laboratory of the National Warm Air Heating and Air Conditioning Association. This manual represents an industry-accepted standard on all the best and proved methods of warm air perimeter heating available. Everyone that is considering the use of warm air perimeter heating in any way should follow the recommendations contained in this valuable manual.—R. W. R.

I HAVE ENCOUNTERED NO SUCH DIFFICULTY

WITH REFERENCE TO the question asked by a reader in the May HPAC concerning warm air supply ducts in the ground, I have not encountered any difficulty in my work as a consulting engineer due to drying or settling of the soil surrounding such ducts. In all cases, I have used concrete either as a formed rectangular duct or poured around sheet metal ducts to a thickness of 3 to 4 in., which arrangement I feel sure will be satisfactory for the life of the building — at least under the weather conditions prevailing in Southern California.

My personal preference is concrete for underground ducts, due to the fact that it is strong, the number of joints can be kept to a minimum and the duct can be integrated with the floor structure. If any doubt exists, I would recommend the use of concrete either formed if the duct section is large or poured around sheet metal if the duct section is small.

It is desirable to avoid excessively hot air in supply systems in the ground under concrete slabs, at least for prolonged periods. In general, the systems which I have used involve air temperatures not exceeding 170 F at the point of entry into the underfloor ducts. Since the specific heat of air is low and the area of contact between air and soil is relatively small, the amount of heat normally lost into the ground is a small proportion of the total available.

Assuming that proper subfloor treatment, such as gravel fill and moisture barriers, is employed and the floor slab is on a well drained site not subject to extreme moisture conditions, I think it unlikely that any harmful settling would occur. — R. C. R.

NEVER HEARD OF ANY SUCH TROUBLE

REGARDING THE possibility that heat from clay pipes carrying warm air through a concrete slab floor might possibly dry out the soil under the slab and result in settling of the floor, I have not heard of any such cases. During the past several years much of my time has been devoted to conducting classes for heating contractors in all sections of the country. The attendance up to the present time has passed the 13,000 mark and with this number in attendance at our meetings, we've had all kinds of questions raised.

Since many of these contractors have had at least a limited experience with systems having warm air ducts embedded in concrete slabs, I believe that if such settling of the slab had occurred, we surely would have had some questions about it. Not having had any such questions asked, I'm inclined to think that the structural engineer who raised the question is worrying about something that just doesn't happen.

For further information on this point may I suggest also the Portland Cement Association. I understand that their engineers have made a very thorough study of the various troubles that might occur with concrete slab construction. — G. A. V.

Asks For Ideas on Preventive Maintenance Program for Air Conditioning

If you don't have the answer to one of your problems, chances are someone else does — or can be helpful on part of it. That's the purpose of this "idea exchange" in each issue, where questions on heating, piping and air conditioning are asked and answered.

You are invited to contribute a question for publication, or an answer to a published question. . . . . Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Here is a question asked by an industrial plant engineer about preventive maintenance programs. Can you help him out?

"We are presently engaged in setting up a preventive maintenance program for the air conditioning installations at our plant. I have seen in several issues of HPAC articles and discussions on how plants and buildings schedule the maintenance operations on air conditioning and heating equipment, and would appreciate your letting me have the references to them. Also, I would welcome any comments or suggestions from other engineers on how to establish a workable preventive maintenance program for industrial air conditioning systems."

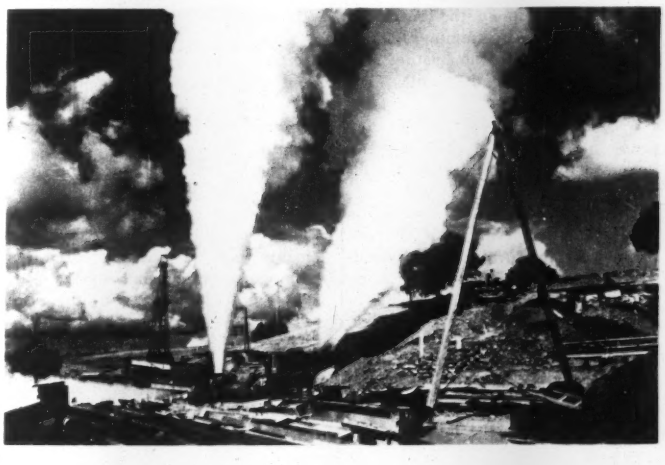
STEAM WELL SUPPLIES 660,000 LB PER HR

MODERN ROTARY DRILLING rigs are helping the Societa Larderello in Italy tap its underground steam supply to expand its power facilities and furnish steam entrained chemicals for industry. Its largest well, brought in last year, has a flowing capacity of 660,000 lb per hr at 100 psia and 437 F.

The development at Larderello is situated in the center of a 77 sq mi area in Tuscany overlaying an unlimited supply of underground steam, which issues from the ground in some places through natural openings called "fumaroles." Actual source of the steam is unkown, but recent studies indicate it may come from the molten magma in the freezing stage, perhaps originating from the crystallization water that is freed from the solidifying magma, according to Alfredo Mazzoni, manager of the Societa Larderello. It is known, however, that the steam is generated at high pressure and rises in considerable volume through clefts and faults to within 20 to 26,000 ft of the earth's surface. In other instances it diffuses through porous sections of the earth to the surface.

One of the power plants, the Larderello No. 3, erected after the close of World War II, is the largest geothermic station in the world. It has four 30,000 kva, 10,500 volt, 50 cycle turbine generators operating on natural steam at 68 psia and 437 F. [Photo courtesy National Supply Co.]

THE NEW WELL is permitted to blow freely until pipe lines can be run to connect it to the feeder system supplying the power house and the chemical works



SAM LEWIS' PAGE

Air Heating for Large Ventilating Systems

AIR HEATING FOR large ventilating systems interposes a continuing problem in climates that have subfreezing hours. When it is necessary to drag subzero air around convectors, there is an ever-present danger of freezing the condensate from steam employed in heating them, or of freezing water that performs the same service, and bursting the metal that encloses the water.

The earliest steam heaters that I encountered comprised vertical 1 in. pipes screwed into thick cast iron bases. Each pipe was connected at its top with an adjacent pipe, and the cast iron base was divided into two separate compartments — one for steam or supply and the other for condensation or return.

Seventy years or so ago the heating medium in this country almost universally was low pressure steam and the steam pressure forced the relatively heavy air out through manually opened vents to the atmosphere. The hot water condensed from the steam also was relatively heavy and would trickle out of the return pipe to the boiler or to a steam driven reciprocating pump that could force the water back into the boiler. If the bottom of the cast iron base was 3 ft or more higher than the water level in the boiler, it sometimes was possible to complete the operating circuit without any pump. But on large projects with the heating surface distant from the boiler, the pump was required.

Vacuum traps and pumps for promoting circulation between the boilers and the heating coils at subatmospheric pressure were not available. Any attempt to control or reduce the temperature of the delivered air by throttling the steam supply to a section of the heating coils would result in an approach to a vacuum, due to condensation. Thus, water would fill that section via counterflow through the return pipe. The answer to this was to leave the steam valve open and to bypass part of the air around the heating coils. There then resulted a mixture of unheated air with heated air, with an average temperature (though somewhat stratified) at any degree intermediate between the two extremes. The old pipe coil heaters under these conditions did not freeze.

Pipe coils for fan systems were made in several different forms — as with the base divided transversely rather than lengthwise, so that a

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems

vertical pipe nearest the steam supply end would connect horizontally with a vertical pipe near the return end of the base. Sometimes a separate supply header would be vertical, feeding horizontal pipes that connected with corresponding vertical ones into a separate return header. This was called a miter coil. After many years, a slab-like cored cast iron convector for fan systems was developed, with hollow steam-filled protuberances, the slabs being connected by screwed cast iron nipples.

This heating surface served successfully for a long time even though when employed in air streams carrying a high relative humidity. Surface of this type never was remarkable for acceptable venting of internal air, though success was approached by installing internal slotted vent pipes screwed through bushings in the normal drainage outlets. These vent pipes were the ancestors of the more modern internal steam distributing tubes used with gilled (finned) thin tube convectors. Control of temperature of the warmed air by means of throttling the steam supply valves was difficult; recourse frequently was taken to bypassing a variable proportion of the air around them.

These convectors were succeeded by gilled thin tube convectors, usually equipped with slotted or drilled internal steam distributing tubes. The rate of heat transfer per unit of surface is very rapid, and this brings about certain difficulties in acceptably modulating the temperature of the air that passes around the tubes. Thus, there are situations where one row of tubes may be insufficient in very cold weather; yet two rows of tubes may cause too high a temperature in mild weather, despite efforts to reduce the transfer rate by throttling the steam supply valve.

An attempt has been made to meet this trouble by variations in the spacing of the gills or fins on the tubes. If the gills are too close each to the other, however, debris deposited by the air sometimes collects and reduces the free area for air passage as well as insulating against heat transfer. In certain localities (especially in cities) corrosive factors in the air have been known rather quickly to denude the tubes of their gills. For these reasons, there is a tendency to provide controlled bypasses for part of the air, and to employ rather wide spaces from gill to gill.

When water rather than steam is used as the heat carrier, a throttling valve on the water supply to each section is of doubtful service in controlling temperature, for it is possible to reduce the rate of water flow by such a valve to the point where freezing and bursting the thin tube occurs.

The conclusion arrives that a bypass for part of the air around a convector that may receive subfreezing air is often advisable.

DATA SHEET

Piping Flow Problems Made Easy

William Goodman Presents Single Chart For Determining Pressure Drop, Pipe Size or Rate of Flow for Any Fluid

BECAUSE OF THEIR convenience, charts are widely used for sizing piping systems. Fig. 1, presented here, eliminates the need for a separate chart for each fluid as it is based on Reynolds' numbers and is universal in scope as long as the flow is turbulent and not streamline. This may be determined by a simple equation, and except for oil, flow is turbulent for most of the cases encountered in commercial engineering work . . . The chart can be used not only to size a pipe for a given rate of flow and pressure drop, but also to determine the rate of flow for a given pipe size and pressure drop, or the pressure drop for a given pipe size and rate of flow . . . A particularly helpful use of the chart is in quickly determining the pressure drop for several different pipe sizes . . . . . Mr. Goodman is a consulting engineer, a professor of mechanical engineering at the Illinois Institute of Technology, Chicago, and a member of HPAC's board of consulting and contributing editors. His article is re-published from an earlier issue of HPAC (with the addition of the data on viscosities from another of the author's articles), as copies of the previous presentation have been out-of-print for some time

CHARTS FOR SIZING piping systems are widely used because of their convenience; however, separate ones are usually required for each different fluid. Fig. 1 eliminates the need for separate charts because it can be used for any fluid — whether liquid or gas — as long as the flow is turbulent and not streamline. It can be used for water, steam, air, brine, ammonia — in short, for any fluid whose density and viscosity are known.

The chart can be used not only to size pipe for a given rate of flow and pressure drop, but also to determine the rate of flow for a given pipe size and pressure drop or the pressure drop for a given pipe size and rate of flow.

Criterion for Turbulent Flow

The Reynolds' number computed by Equation 1 determines whether the flow will be turbulent or streamline. If the Reynolds' number is greater than approximately 2000, the flow will be turbulent and Fig. 1 may be used for the solution of the problem. If it is less than 2000, the flow is likely to be streamline and Fig. 1 should not be used. Except for oil, the flow is turbulent for most of the cases encountered in commercial engineering work.

$$Re = 378.8\ (W/Du) \quad \ldots\ldots\ldots [1]$$

Description of the Chart

Fig. 1 consists of two parts: the scales of diameter, pressure drop and weight are on the left side and the scales of density and viscosity are on the right. To use the chart for a particular fluid, enter the right side at the density of the fluid as at A of Fig. 2. Find the point B where the vertical line through A intersects the diagonal line representing the viscosity of the fluid. The horizontal line BH drawn through B represents the particular fluid on the left side of the chart and this one particular line is used for all problems involving that particular fluid.

A few examples will show the use of the chart. Example 1 illustrates its use for finding the pipe size for a given pressure drop for two such different fluids as water and ammonia vapor.

Example 1: Find the size of pipe needed for a flow of 500 lb per min and a maximum pressure drop of 0.5 lb per sq in. per 100 ft of pipe length if (a) the fluid is water at 68 F. and (b) if the fluid is saturated ammonia vapor at 45 F.

Solution: (a) For water at 68 F. density $d = 62.3$ lb per cu ft and (from Fig. 5) viscosity $u = 1$ centipoise. The method of using Fig. 1 to find the pipe size is illustrated in Fig. 2.

Enter the chart at point A for a density of 62.3 lb per cu ft. Locate point B where the vertical line through the density of 62.3 intersects the diagonal viscosity line of 1 centipoise.

Now enter the chart at C for a flow of 500 lb per min. Extend a vertical line through C until it intersects at D a horizontal line drawn through B. The pipe size for various pressure drops can now be read along the diagonal directrix line DF through point D.

Enter the chart at point E for a pressure drop of 0.5. Extend the horizontal line through E until it intersects the diagonal directrix at F. Drop down vertically from F to the pipe size scale and read 3 in. as the internal diameter of the pipe required.

To check whether Fig. 1 is applicable to this problem, substitute the numerical values of this example into Equation 1.

$Re = 378.8 \times [500/(3 \times 1)] = 63{,}130$

b) For saturated ammonia vapor at 45 F, density* $d = 0.28$ lb per cu ft and viscosity $u = 0.01$ centipoise. Again Fig. 2 serves as a guide for using the chart of Fig. 1.

Enter the chart at point A for density of 0.28 lb per cu ft. Locate point B where the vertical line through the density of 0.28 intersects the diagonal viscosity line of 0.01 centipoise.

Now enter the chart at C for a flow of 500 lb per min. Extend a horizontal line through B until it intersects the vertical line of 500 lb per min at point D. The pipe size for various pressure drops can now be read along the diagonal directrix line DF through point D.

Enter the chart at point E for a pressure drop of 0.5 lb. Extend the horizontal line through E until it in-

*From Bureau of Standards Circular No. 142.

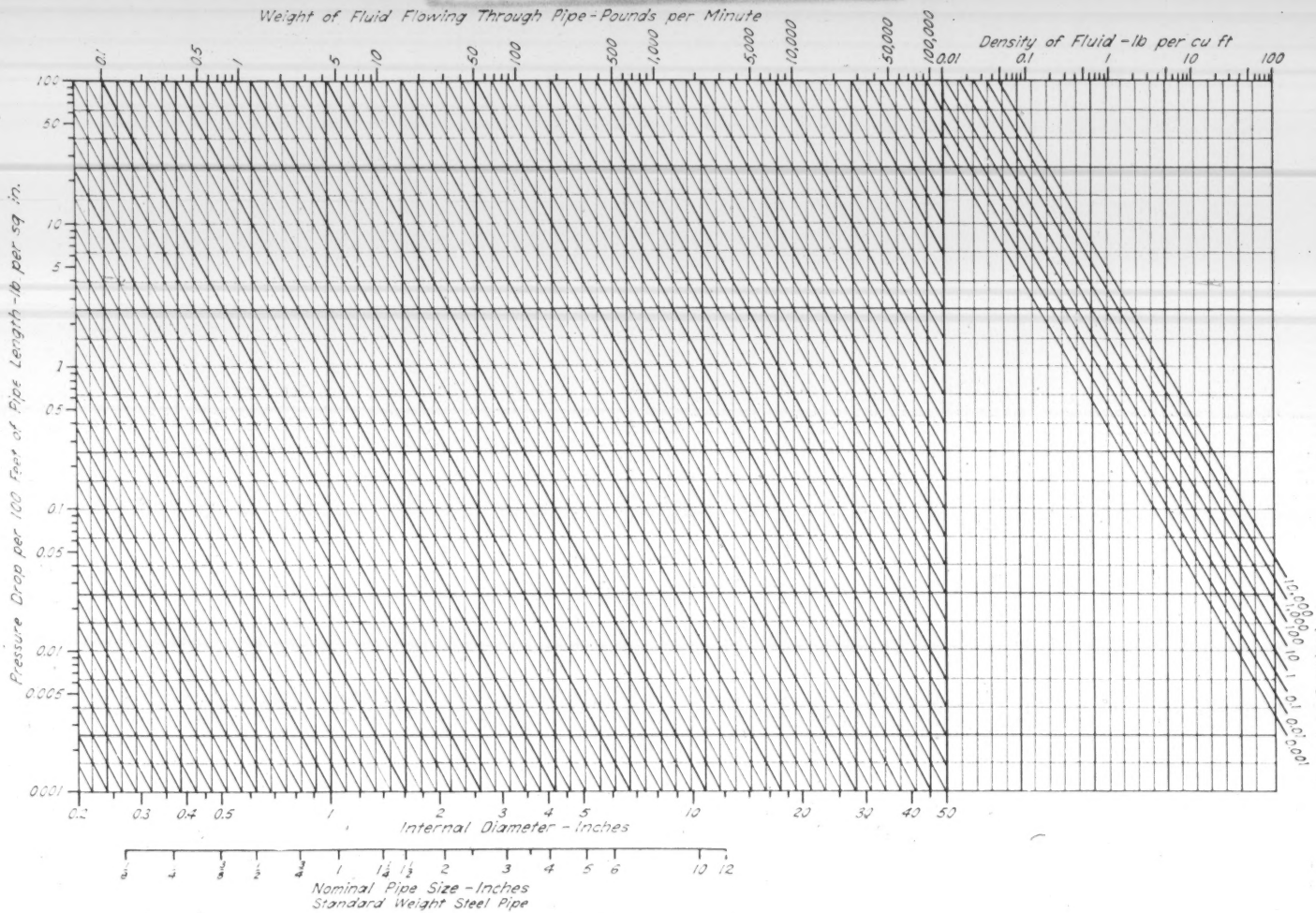


FIG. 1—**UNIVERSAL CHART** for fluids in turbulent flow — for determining pressure drop, pipe size or rate of flow. (Chart is for clean commercial steel or cast iron pipe; for clean copper pipe, the pressure drop will be lower than that obtained from this chart and consequently the chart can be used safely for copper pipe.)

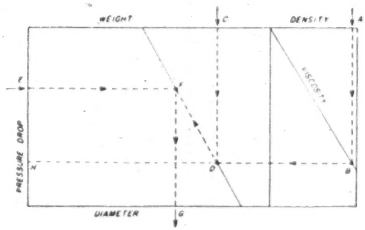


FIG. 2—SKELETON CHART showing how Fig. 1 is used for determining either pressure drop or pipe size

tersects the diagonal directrix at *F*. Drop down vertically from *F* to the pipe size scale and read 8 in. as the internal diameter of the pipe required.

To check whether Fig. 1 is applicable to this problem, substitute the numerical values of this example into Equation 1.

$$Re = 378.8 \times [500/(8 \times 0.01)] = 2{,}368{,}000$$

Once familiarity with the chart is acquired, not only the pipe sizes but a great variety of piping flow problems can be solved. The following example illustrates the method of using the chart to find the pressure drop for a given pipe size and flow.

Example 2: Compressed air is flowing through a pipe of 4 in. inside diameter at the rate of 75 lb per min. The air has a density of 0.48 lb per cu ft and a viscosity of 0.019 centipoises. Find the pressure drop.

Solution: Fig. 2 serves to illustrate the use of Fig. 1.

Enter the chart at point *A* for a density of 0.48 lb per cu ft. Locate point *B* where the vertical line through the density of 0.48 lb per cu ft intersects the diagonal viscosity line of 0.019 centipoises.

Now enter the chart at *C* for a flow of 75 lb per min. Extend a vertical line through *C* until it intersects at *D* a horizontal line drawn through *B*. Locate the diagonal directrix line through point *D*.

Now enter the chart at *G* at an internal pipe diameter of 4 in. and extend a vertical line up until it intersects the diagonal directrix line *DF* at point *F*. Extend a horizontal line through point *F* and read a pressure drop of 0.27 lb per sq in. per 100 ft of length at point *E*.

To check whether Fig 1 is applicable to this problem, substitute the numerical values of this example into Equation 1.

$$Re = 378.8 \times [75/(4 \times 0.019)] = 373{,}800$$

In selecting pipe sizes, it is frequently of help to be able to determine quickly the pressure drop for several different size pipes. When this is done, it will usually be found that above a certain size the pressure drop decreases very slowly so that there is no advantage in going above this size. To determine the pressure drop for several different pipe sizes, it is necesary only to read the pressure drop where each vertical line of pipe size intersects the directrix *DF* of Fig 2. The same sloping directrix determined by the density, viscosity and rate of flow used for all of the different size pipes.

As an illustration, for the conditions of Example 2, the pressure drops listed below were determined for several different size pipes; all of these were read along the same sloping directrix *DF:*

Pipe Size, In.	Pressure Drop, Lb per Sq In. per 100 Ft
2	7.5
3	1.1
4	0.27
5	0.09
6	0.037

Rate of Flow Through Pipe Line

Fig. 1 can also be used to determine the rate of flow through a given size pipe for a given pressure drop. Example 3 illustrates this.

Example 3: The pressure drop through a pipe line of 3 in. internal diameter is not to exceed 0.1 lb per 100 ft of pipe length. Find the maximum flow in the pipe line if the fluid is (a) saturated steam at 300 F, and (b) if calcium chloride brine of 1.2 specific gravity at a temperature of 60 F.

Solution: Fig. 3 serves to illustrate the method of using Fig. 1 for solving a problem of this type.

a) For saturated steam at 300 F,

LIST OF SYMBOLS

- D = pipe diameter, in.
- d = density of fluid, lb per cu ft
- f = friction factor
- L = equivalent length of pipe, ft (includes losses due to fittings, and entrance and exit losses)
- p = pressure drop in pipe line, lb per sq in. per 100 ft of pipe length
- Re = Reynolds' number
- u = viscosity of fluid, centipoises
- W = weight of fluid flowing through the pipe, lb per min

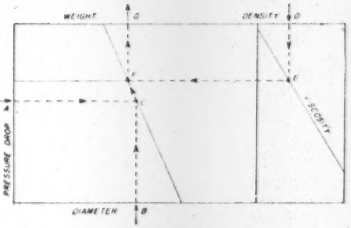


FIG. 3—SKELETON CHART showing how Fig. 1 is used for determining the weight of fluid that will flow through a pipe of given size for a given pressure drop

density† $d = 0.155$ lb per cu ft. Viscosity $u = 0.015$ centipoise. Enter Fig. 3 at point *A* for a pressure drop of 0.1 lb per 100 ft. Also enter at point *B* for an internal pipe diameter of 3 in. The vertical line through *B* and the horizontal line through *A* intersect at point *C*, locating *CF*, the diagonal directrix through point *C*.

Now enter the chart at point *D* at a density of 0.155. Locate point *E* where the vertical line through *D* intersects the diagonal viscosity line of 0.015 centipoise. Extend a horizontal line through *E* until it intersects the diagonal directrix line *CF* at point *F*. Draw a vertical line through point *F* and read at point *G* a flow of 11 lb per min of steam.

To check whether Fig. 1 is applicable to this problem, substitute the numerical values of this example into Equation 1.

$$Re = 378.8 \times [11/(3 \times 0.015)] = 92{,}590$$

b) Density d of 1.2 specific gravity calcium chloride brine is $62.3 \times 1.2 = 74.8$ lb per cu ft. Viscosity $u = 2.4$ centipoises.

Use the same directrix line *CF* in Fig. 3 as was previously located in part (a) of this example. Enter the chart of Fig. 3 at point *D* for a density of 74.8 lb per cu ft. Drop a vertical line from point *D* until it intersects the diagonal viscosity line of 2.4 centipoises at point *E*. Draw a horizontal line through point *E* until it intersects the diagonal directrix line *CF*. From the point of intersection draw a vertical line up to the flow scale and read at *G* a flow of 205 lb per min of brine.

To check whether Fig. 1 is applicable to this problem, substitute the numerical values of this example into Equation 1.

$$Re = 378.8 \times [205/(3 \times 2.4)] = 10{,}790$$

From the examples given here, it

†From Keenan and Keyes steam tables.

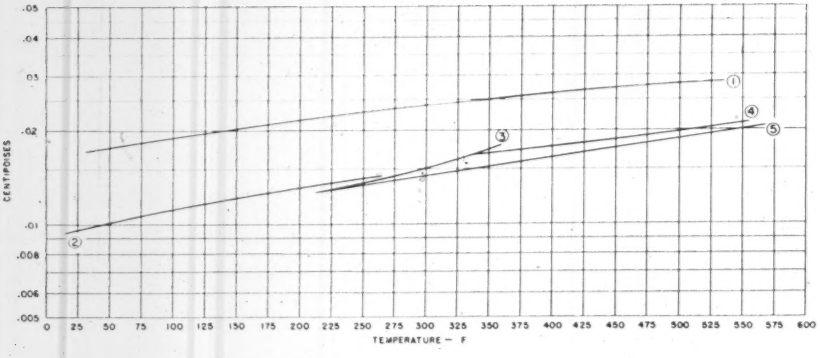


FIG. 4—VISCOSITIES of a few gases and vapors

Curve No.	Substance	Source of Data
1	Air	Int. Critical Tables
2	Ammonia	Reed & Ambrosius, Heating, Piping & Air Conditioning, June 1930
3	Saturated Steam	Schüle—Technical Thermodynamics
4	Steam 100 lb ga press.	Schüle—Technical Thermodynamics
5	Steam 0 lb ga press.	Schüle—Technical Thermodynamics

is evident that the chart of Fig. 1 is versatile and can be used to solve practically any type of turbulent flow problem involving any fluid whose density and viscosity fall within the range of scales given on the chart.

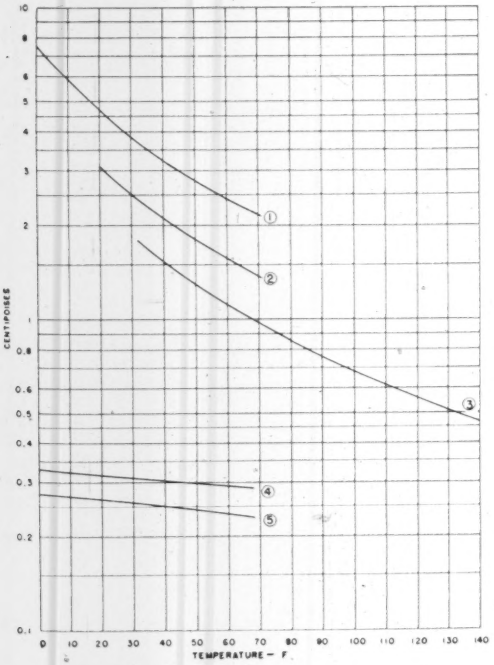


FIG. 5—VISCOSITIES of a few liquids

Curve No.	Substance	Source of Data
1	Calcium chloride 1.2 specific gravity	Gould & Levy, Univ. of Ill. Bulletin No. 182.
2	Calcium chloride 1.1 specific gravity	Gould & Levy, Univ. of Ill. Bulletin No. 182.
3	Water	Int. Critical Table.
4	Methyl chloride 99.6 lb absolute press.	Refrig. Data Book.
5	Ammonia, 171 lb absolute press.	Refrig. Data Book.

The chart has been drawn for commercial pipe from the following formula:

$$p = 0.0007843\ (u^{0.17}/d)\ (L/D^{4.83})\ W^{1.83} \quad \ldots\ldots[2]$$

This equation is obtained from the basic Fanning equation:

$$p = 0.01209\ (f/d)\ (L/D^5)\ W^2 \quad \ldots[3]$$

The value of the friction factor f is represented by the following equation:

$$f = (0.178/Re^{0.17}) \quad \ldots\ldots[4]$$

Substituting Equations 1 and 4 into 3, Equation 2 is obtained.

Equation 4 gives values of the friction factor f that are higher than those obtained from the curve marked *A* in Fig. 1 on p. 626 of the October 1937 HPAC for all values of Reynolds' numbers from 6000 to 1,000,000. For values of Reynolds' numbers between 2000 and 6000 and for Reynolds' numbers between 1,000,000 and 2,500,000, the friction factors given by Equation 4 are slightly lower than those obtained from this curve. However, Equation 4 can safely be used for values of Reynolds' numbers as low as 2000, which is the lower limit for turbulent flow. It can also be used for the values of the Reynolds' numbers as high as 2,500,000 without serious error. The reason for this is that the above-mentioned curve is derived from experimental data of Drew, Koo and McAdams** and represents the average value of a large number of experimental points which plot as a band rather than as a single line on the chart. The straight line represented by Equation 4 plots within or slightly over the band, and for most of the range is on the safe side.

**Drew, Koo & McAdams, *Transactions*, American Institute of Chemical Engineers, Vol. 28, 1932, pp. 56-72.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

A Study of a Transient Heat Method for Measuring Thermal Conductivity

By D. D'Eustachio* and R. E. Schreiner**, Port Allegany, Pa.

SUMMARY — An instrument consisting of an electrically heated probe 4 in. long and 0.030 in. in diameter has been constructed and used for measuring thermal conductivity of insulating materials. Tests on cellular glass have shown good agreement with the guarded hot plate and excellent reproducibility for a range of power inputs. The results indicate that any reasonable clearance between the probe and the insulation has little effect on the thermal conductivity determination. In its present form, with stainless steel tubing as a protective sheath, it is difficult to use the instrument for absolute determinations. However it appears practicable to further reduce the diameter and heat capacity by discarding the metal tube. With this change absolute calibration to better than one percent should be possible.

MANUFACTURERS and users of insulation have for a long time needed a fast method for measuring thermal conductivity, a method which would have the precision of the Guarded Hot Plate Method *(ASTM C 177)* while avoiding most of its problems. Steady state methods are not too promising for this purpose since attainment of satisfactory equilibrium for accurate measurement is necessarily time consuming in a poor conductor. In addition, all the steady state procedures need careful instrumentation and adjustment to insure proper balance between the guard and test areas, and this means large and expensive installations requiring considerable skill to maintain and operate.

In comparison to steady state methods, transient heat methods have always appeared attractive. Of the many modifications suggested, only one seems to be promising as a possible substitute for the guarded hot plate. This method utilizes a line heat source. Suggested as early as 1888,[1] it was not until 1948 that the method was used successfully to obtain accurate thermal conductivity measurements by van der Held and van Drumen[2]. They measured the thermal conductivity of a number of liquids. An electrically heated wire was used as the line source, and a thermocouple was attached to the wire, for measuring temperature. They pointed out the many difficulties of trying to use the change in resistance of the wire for measuring the change in temperature and concluded that thermocouples were more satisfactory. Reproducibility was reported to be 2 percent. In a number of cases results were compared with those obtained by others with more conventional methods. In all cases the agreement was excellent. Major contributions of van der Held and van Drumen were a careful examination of the error produced by the finite diameter of the source and the devising of a method of applying a suitable correction. They also studied the effect of a finite wire length.

In 1950 Hooper and Lepper[3] described a modification of the experiment in which the line heat source was constructed from an aluminum tube 3/16 in. in diameter and approximately 19 in. long. The heater was a constantan wire stretched through the center of the tube. They developed the instrument, which they called a thermal conductivity probe, especially to measure the conductivity of moist soils. Reproducibility of ½ percent was claimed and it was stated that the instrument would measure with equal precision the conductivity of wet or dry materials.

The theory of the transient heat flow method, using a line source, for measuring thermal conductivity is developed in detail in Carslaw and

*Physicist, Pittsburgh Corning Corp.
**Technician, Pittsburgh Corning Corp.
[1]Exponent numerals refer to References.
For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Spring Lake, N. J., June 1952.

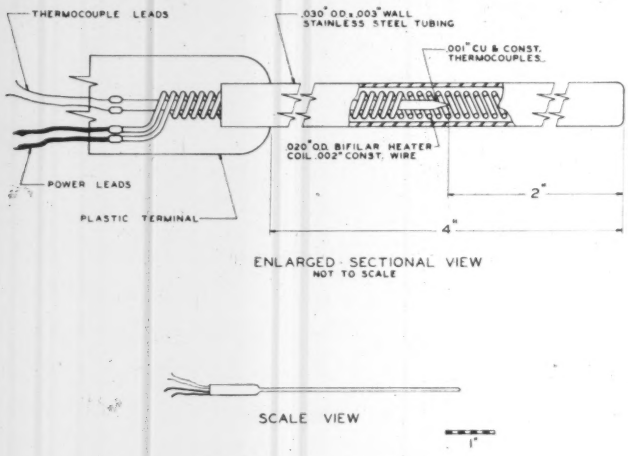


Fig. 1 — Schematic diagram of probe construction

Small outline drawing shows relative proportions of instrument.

Jaeger[4], and Ingersoll, Zobel and Ingersoll.[5] These authors show that the temperature at any point in an infinite mass of material heated by a line source will be

$$\theta = \frac{Q}{2\pi k} I\frac{r}{2\sqrt{\alpha t}} \qquad (1)$$

where

Q = heat input per unit length per unit time.
k = thermal conductivity.
r = distance from heat source.
α = thermal diffusivity.
t = duration of heating.
$I(x)$ = an integral whose value for $x < 0.2$

$$I(x) = \log_e\left(\frac{1}{x}\right) + \frac{x^2}{2} - \frac{x^4}{8} - 0.289$$

$$x = \frac{r}{2\sqrt{\alpha t}}$$

From this it follows immediately that

$$k = \frac{Q}{4\pi}\,\frac{\log_e\left(\frac{t_2}{t_1}\right)}{\theta_2 - \theta_1} \qquad (2)$$

where θ_1 is the temperature at time t_1 and θ_2 is the temperature at a later time t_2. It is interesting to compare Equation 2 with the more familiar expression for thermal conductivity of a cylinder under steady state conditions. The comparison makes the physical measuring of the test method immediately apparent. The striking thing about this expression for the thermal conductivity is that it is independent of the thermal diffusivity of the material. This, of course, is only true when the experimental parameters are properly chosen. Furthermore, all the quantities required in Equation 2 can be easily measured with adequate precision with relatively simple equipment.

Any practical instrument will have a finite diameter. It is also desirable to make the device as short as possible. This means that, in general, two corrections must be applied: one for the diameter of the probe and one for end losses. As previously stated van der Held and van Drumen investigated both these problems. They have shown that the presence of the instrument in the insulation is equivalent to heat production before the start of measured time, that is, an interval, t_0, must be subtracted from both t_1 and t_2 to obtain applicable time intervals. They described a graphical method for obtaining this correction. Our experience indicates that correct instrument design will probably make such a correction unnecessary for any but the most exacting work.

A comparison of a probe technique for measuring thermal conductivity with the more usual guarded hot plate method brings out some interesting points. The probe type of instrument is simple and much less costly, requires relatively little auxiliary equipment, and the actual measuring procedure is easy. The testing is done on a fairly small portion of the insulation. This means that accurate results can only be obtained with homogeneous materials. In the instrument described in this paper differences of only a few degrees are required. Thus, it is possible to explore accurately the relationship between temperature and thermal conductivity. Finally, the small size of the instrument and the need for a rather small piece of material to be tested means that the instrument can be readily adapted for measurements under extreme conditions. For example, a piece of insulating material, with a probe inserted in it, can easily be placed in a container of liquid air for determination of thermal conductivity at —300 F. The experiment is hardly more difficult than a routine measurement at room temperature and there is no reason for expecting any decrease in precision of the result. In contrast, the difficulties of any accurate steady state measurement of thermal conductivity at this low mean temperature are almost insurmountable.

The probe described in this paper is insulated with plastics that can be used over a rather limited temperature range. However, an instrument can be easily constructed, using ceramic materials for insulation, so that it can be used both at higher and lower temperatures than is possible with organic insulation.

Description of the Probe

The basic criterion used in the design of the new instrument was that the temperature change in the material whose conductivity was being measured should be as small as possible. A number of experimental models were built following the general construction used by Hooper and Lepper. It soon became clear that significant reduction in diameter

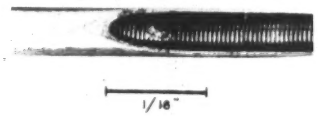


Fig. 2 — Micro-photograph of portion of probe
A part of metal housing has been filed away to show construction and placement of heater.

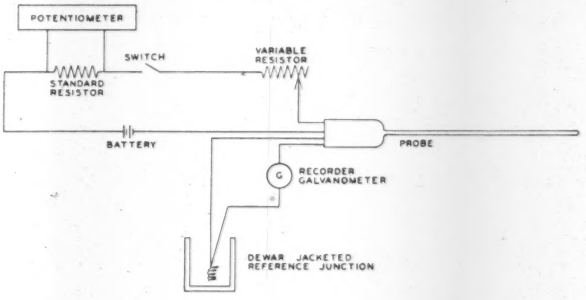


Fig. 4 — Schematic diagram of electrical connections for probe and recorder

was necessary if smaller temperature changes were to be used, and that changes in design were needed to attain the required reduction in size. It was necessary to keep the electrical resistance of the heater high and at the same time make the overall length of the heater short. This was accomplished by using a bifilar spiral wound of 2 mil constantan wire for the heating element. The clearance between the stainless steel housing and the spiral was made as small as possible. Care was taken to insure uniform spacing in the winding. Thermocouples, connected in series, were placed inside the coil.

The actual steps in the construction of the probe were as follows: First, the bifilar coil was wound on a small diameter aluminum tube. A polyamide filament was used as a spacer. After completing the winding the spacer was removed and the coil was bound together with a thermosetting plastic. Then, the aluminum tube was removed by dissolving it with dilute acid. Next, insulated 1 mil copper constantan thermocouples were placed inside the coil. The heater and thermocouple assembly was then placed inside the stainless steel housing and was vacuum impregnated with a coldsetting plastic. Finally, a plastic knob was cast at one end to act as support for the leads. The general design is shown schematically in Fig. 1. Fig. 2 is a micro-photograph of a portion of the instrument with part of the housing cut away to expose the heater coil.

The need for accurate measurement of a small temperature change as a function of time precluded the use of a manually operated potentiometer. Instead, a simple recording system was used. It consisted of a high-sensitivity galvanometer having a period of 1.3 sec. and means for recording galvanometer deflections directly on photographic paper mounted on a rotating drum. The optical arrangement was fairly conventional and very similar to that described by Strong.[6] The photographic paper used had a specially treated base to prevent dimensional change during processing. With this arrangement it was possible to measure temperature changes of 0.01 F deg. The attainable precision was established by the thermocouple calibration and not by the recorder system. Fig. 3 is a photograph of the recorder and galvanometer setup. The probe thermocouples were calibrated in place after completion of any one instrument, using a Beckman thermometer as a standard. To reduce Thompson effect to a minimum, it was found desirable not to use an ice bath for the thermocouple reference junction. Instead, the reference junction was placed in a half-pint Dewar flask filled with water and supported inside of a larger covered Dewar flask. The double-flask arrangement was placed inside the same constant temperature box in which the samples were stored for conditioning prior to measurement. The drift of the reference junction was found to be less than 0.01 F deg per hour when the water in the small flask was 1 deg colder than the ambient. During test runs the ambient temperature was held to within 0.1 F deg of the reference junction. As a result, the drift of this junction was probably less than 0.001 F deg per hour and is certainly negligible.

The electrical connections for the entire apparatus are shown schematically in Fig. 4. A lead storage cell made a convenient power source. With it, power was easily maintained constant to better than 0.2 percent.

All samples were stored in a well insulated cabinet for 6 to 8 hr before

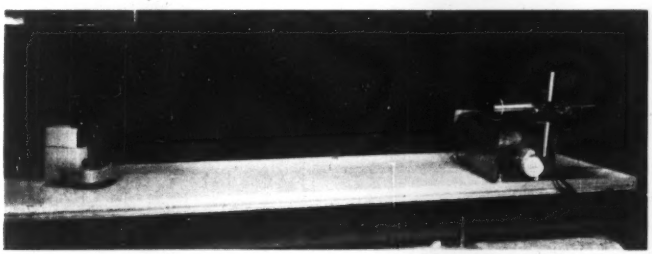


Fig. 3 — Temperature recorder

Galvanometer is on left and drum recorder with associated optics on right. Note special mount to prevent external vibrations from affecting recorder. The precision reported is obtainable with so simple a recorder only if the mounting is such that external vibrations are suppressed sufficiently to permit recording a trace less than 0.002 in. wide. Synchronous motor used to drive drum is easily changed so that a wide variety of chart speeds is available.

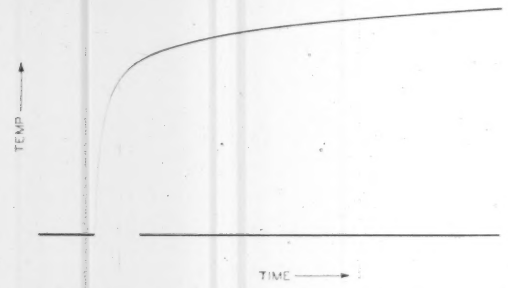


Fig. 5 — Typical time *vs.* temperature trace produced by recorder

Base line obtained by running recorder before applying power to probe, also serves to indicate that temperature of specimen has been properly stabilized. This reproduction is made from a drawing. The line width of the original trace on the chart is about 1/10 of that shown on the figure.

any measurements were made on them, thus insuring a constant temperature throughout any specimen. The temperature of the cabinet was held constant within less than 0.1 F deg by means of a mercury thermostat.

A typical time-temperature record is shown in Fig. 5. The recorder was started some time before power was applied to the probe. This served not only to establish a base line, but also to check the sample for temperature drift.

Results

Table 1 gives a number of the results obtained with the instrument. It is particularly interesting to observe that an air space between the probe and the insulation equal to 50 percent of the diameter of the instrument does not seem to affect the results obtained when the power input is sufficiently low. This is in agreement with theoretical expectations for a small-diameter probe. No attempt has been made to apply a zero correction to any of these tests.

Fig. 6 shows the temperature distribution along one of the probes as a function of time. From these data can be calculated the heat flow along the metal tube at the end of any desired time interval. For example, at the end of 10 min., the heat flow along the tube, in the central portion, is less than 0.1 percent of the heat input. The average axial heat flow during the measuring interval is less than this. Hence, it might be concluded that the end losses of the instrument are negligible. This, however, is not strictly so, since the front of the heat wave begins to depart from a cylinder at relatively small distances from the probe. This difficulty has been circumvented by limiting the power input and the total time of observation to a minimum. These expedients may, however, interfere seriously with the precision of the measurements under certain circumstances. To overcome this condition an instrument is being designed to be still smaller in diameter and to have a lower heat capacity.

Table 1 — Comparison of Results from Probe Guarded Hot Plate Value

Test	Specimen	Temp. Rise F Deg	Watts/ft	Conductivity *k* at 100 F Probe	GHP[a]	% Variation
19	Cellular Glass[c]	34	0.20	0.433	0.431	+0.4
23	Cellular Glass[c]	18	0.19	0.419		−2.6
25	Silica Gel	2.6	0.07	0.180	0.172	+4.7
75	Cellular Glass[d]	3.8	0.05	0.408	0.410	−0.5
73	Cellular Glass[d]	5.6	0.06	0.414		+0.9
74	Cellular Glass[d]	5.4	0.08	0.407		−0.7
76b	Cellular Glass[d]	2.0	0.05	0.412	0.410	+0.5
77b	Cellular Glass[d]	4.1	0.06	0.416		+1.6
78b	Cellular Glass[d]	6.1	0.08	0.434		+6.0

[a]Guarded Hot Plate
[b]50 Percent diametral clearance around probe
[c]Older Type
[d]New Type

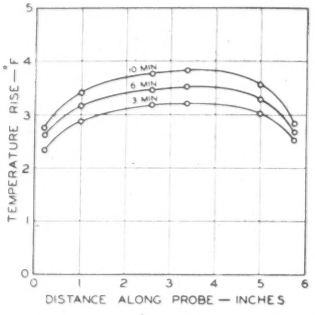


Fig. 6 — Temperature distribution along axis of probe as a function of time for 0.011 watts power input
Axial heat flow determined from these data indicates departure from theoretically ideal performance.

Discussion

The work described has shown that a small thermal conductivity probe can give results equal in reproducibility to the best obtainable with the guarded hot plate. However, the authors are not confident that the probe in its present form can be used for absolute measurements because there is no simple way of evaluating the effect of the non-radial heat flow. As suggested, the problem can be solved by reducing the diameter and heat capacity and possibly increasing the length. The major problem in building such a probe is to obtain sufficient strength and durability to make the device practical as a test instrument. There are indications that a fiberglass sleeve, impregnated with a suitable plastic, can be substituted for the metal housing with-

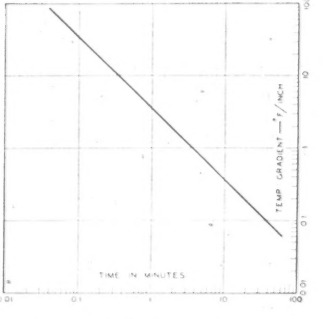


Fig. 7 — Calculated temperature gradient in insulation at probe surface as a function of time

out appreciable loss in strength. Such an instrument will have about $\frac{1}{8}$ of the axial conduction of the metal sheath probe and less than $\frac{1}{2}$ of its heat capacity per unit length. It is not difficult to decrease its diameter to less than 0.020 in. With these changes it will be feasible to use lower power inputs, lower temperature gradients in the insulation, and shorter time periods, without sacrificing precision. With these modifications the departure of the performance from the theoretical ideal should be so small that it can easily be calibrated on an absolute basis. Fig. 7 shows the calculated temperature gradient in the insulation as a function of time. The curve is based on the present instrument with a power input of 0.05 watts per ft. This is the minimum input the authors have found it possible to use and still obtain a precision better than 1 percent. However, with the changes in probe design suggested, the power requirement for 1 percent accuracy will be of the order of 0.01 watts per ft, and consequently the temperature gradients will be approximately 1/5 of those shown in Fig. 7, so that 10 sec after applying the power there will be no temperature gradients exceeding a few degrees per inch in any part of the insulation where measurements are being made. During any time when the gradients are higher than this the material under test will be not more than a few tenths of a degree above its original temperature. Under these conditions the authors believe that it will become possible to obtain very interesting results on the effect of moisture on the thermal conductivity of insulants.

Acknowledgment

The authors wish to thank Pittsburgh Corning Corp. for the interest shown in this work and for permission to publish the results. They also wish to acknowledge the able assistance of Paul Bressan with many of the experimental details.

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4. *Conduction of Heat in Solids*, by H. S. Carslaw and J. C. Jaeger (Clarendon Press, Oxford, 1947).

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Resolution Pratique des Problemes de Discontinuite de Fonctionnement dans les Installations de Chauffage Central, by A. Nessi and L. Nisolle. (Dunod, Paris, France, 1933)

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Discontinuite de Fonctionnement des Installations de Chauffage, by A. Nessi. (Extrait du volume, Mecanique et Chaleur, 1949)

The presentation of textbooks and pamphlets in the field of heating, ventilating, and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

DR. WINSLOW HONORED

Dr. C.-E. A. Winslow, past president of the Society and professor emeritus of public health of Yale University, received the Leon Bernard Foundation Medal and prize of 1,000 Swiss francs (about $230) at a session of the World Health Assembly of the United Nations World Health Organization on Tuesday, May 13, in Geneva, Switzerland.

C.-E. A. Winslow

The award is given "for outstanding contribution to the progress of social medicine." Professor Winslow was one of the initiators of the movement that ultimately produced the World Health Organization. With Prof. Leon Bernard, for whom the award is named, he helped to organize the health section of the League of Nations in 1921.

Effectiveness and Temperature Requirements for Cooling Panels Removing Internal Radiation

By Merl Baker*, Lexington, Ky.

SUMMARY — This paper presents a simplified theoretical analysis of the removal of internal radiation by use of cooling panels. Equations are developed enabling the determination of the effectiveness of enclosed radiant energy sources in heating the room air, together with expressions for the cooling load requirements. From the established relationships, both the panel cooling and the convective load components may be calculated for any given panel temperature, or the required panel temperature may be computed in accordance with the comfort equation. The theoretical analysis is supplemented by examples and design charts.

Internal radiation emitted from electric lighting filaments may constitute a major portion of the total cooling load. For structures not equipped with cooling panels, the effectiveness of this energy in heating the room air varies with the equivalent overall conductance of the enclosure and ranges approximately from 96 to 68 percent for good and poor insulation, respectively. By use of cooling panels possessing a conventional finish, these values decrease appreciably ranging from approximately 62 to 48 percent. A further decrease to approximately 52 to 45 percent is accomplished by use of a heat-absorbing panel surface.

BECAUSE of the danger of surface condensation, the feasibility of panel cooling has often been questioned. However, the recognition of the fact that many cooling loads are comprised of large sensible and minor latent components has opened the way for the practical application of panel cooling, supplemented by auxiliary dehumidifying equipment. The favorable load condition is particularly predominant for spaces subjected to an intense lighting load. The high operative temperature of the incandescent filaments enables the enclosure surface to act as a cooling panel although its temperature is no lower than that of the room air. The reception of radiant energy by the enclosing surfaces reduces the heating effect of the energy supplied to the lights. Panels operating at a surface temperature below the ambient, absorb heat by convection from the room air and by radiation from warmer surfaces, in addition to that gained by direct radiation from the lighting filaments. The increased cooling produced by the panels decreases the supplementary sensible heat sink (which must absorb all of the latent heat load) that must be provided.

Considerable interest in this phase of panel cooling has been manifest in recent years as evidenced by papers of Leopold[1] in 1947 and 1948 and followed in 1949 by Mackey and Gay[2] and the author[3,4]. The presentation by the author in 1949 included development of theoretically exact equations from basic relationships of Raber and Hutchinson[5,6,7,8,9], and a comparison with experimental data. Although the agreement between experiment and theory is satisfactory, the application of the theoretical equations to design is laborious.

Radiant energy is of such a nature that it does not produce heat until it is absorbed. Since approximately 80 percent of the electrical input to an incandescent filament is initially emitted as radiation, no appreciable heating is encountered except at surfaces which are able to absorb radiant energy. The ability of carbon dioxide and water particles within the air to absorb radiant energy is usually quite small with the percentage absorption being less than ten.[9] While some energy is absorbed by occupants and furniture, approximately 70 percent of the electrical input is absorbed at the enclosure surfaces.[4] A part of the heat produced by absorption of radiant energy and originating at the enclosure surfaces, excluding the cooling panel surface, is conveyed to the room air. The ratio of the sum of this heat quantity plus that directly added to the air by the filament, to the electrical input of the filament, represents the effectiveness of the lighting load in heating the air. *This ratio is less than unity for all cases except that of a perfectly insulated enclosure.*

Cooling panels may be employed to reduce the effectiveness ratio even when operating at relatively high temperatures[1,2,3,4]. A cooling panel maintained at the same temperature as the room can, in the limit of infinite conductivity, reduce the effectiveness ratio to 30 percent. This is a very significant achievement when the lighting load represents a

*Assistant Professor of Mechanical Engineering, University of Kentucky. Junior Member of ASHVE.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Spring Lake, N. J., June 1952.

[1]Exponent numerals refer to References.

major load component. By lowering the panel temperature to some value below the room air temperature, sufficient sensible heat is removed to produce a comfortable environment. In general, it is desirable to design cooling panels to remove as much sensible heat as possible without lowering the surface temperature too near the dewpoint of the room air.

Cooling Load from Lights in the Absence of Cooling Panels

It has long been known that the lighting load component, obtained by multiplying the electrical input measured in watts by 3.42, is in excess of the true heat gain although still commonly used in computing heat gain. No great error results in the total load when the lighting load is small relative to other components, but this is not always the case.

The absorption of radiant energy by the enclosure surfaces causes a higher inside surface temperature and thereby reduces the outside-inside temperature differential. This lowers the heat transmission by conduction, and therefore, the sum of the electrical input to the filament and the heat gained by conduction, while the filament is heated, is always less than the sum of the two components when the conduction gain is calculated without consideration of the filament radiation. From the difference of the two totals, the effectiveness of the filament in heating the air is derived. Equation 1 relates the energy lost to the inside air from the enclosure surface and that received at the surface through conduction from the outside and by radiation from the internal energy source.

$$h_c A_c (t_c - t_a) = A_c C_e (t_o - t_c) + E''_e \quad \ldots\ldots\ldots\ldots (1)$$

where

h_c = unit thermal conductance by convection for enclosure inside surface, Btu per (square foot) (hour) Fahrenheit degree temperature difference between surface and air in room).

A_c = inside surface area of enclosure, square feet.

t_c = temperature of inside surface of enclosure, Fahrenheit.

t_a = temperature of air in room, Fahrenheit.

t_o = temperature of outside air, Fahrenheit.

C_e = equivalent conductance of *wall* construction, Btu per (square foot) (hour) (Fahrenheit degree temperature difference between inside surface and outdoor air). (*Wall* denotes any surface such as wall, floor, glass).

E''_e = total radiant energy received by the inside *enclosure* surface from internal sources, Btu per hour. (*Enclosure* refers to the combination of all surfaces of a room except heating or cooling panels).

The air within the room may receive heat from the inside enclosure surface, internal heat sources, infiltration of warm air, and transmission of solar energy through glass, and lose heat to a cooled surface such as a conditioning coil. Relating these terms,

$$h_c A_c (t_c - t_a) + 0.30\,E + 0.24\,W\,(t_o - t_a) + Q = R \quad \ldots\ldots (2)$$

where

E = energy input to incandescent filaments, Btu per hour.

W = weight of outside air entering the room by infiltration or through the ventilation system, pounds per hour.

Q = sum of all convective sensible heat components occurring within the room, excluding those of the lighting filaments, Btu per hour. (Solar energy transmitted through glass is absorbed within the room and is assumed to be ultimately transferred to the air, and must be included in this term).

R = sensible heat removed from the room air by a convective cooling surface such as a coil.

In the evaluation of total radiation received at a particular surface of an enclosure, the geometry and surface characteristics of the system must be considered. From basic equations of Raber and Hutchinson[5], the author[4] formulated a simplified expression for the total radiant energy received at an enclosure surface when initially radiated from an internal source. This particular equation is written for the energy received at surface n, any surface of the enclosure, for radiant energy emitted from an internal source as follows:

$$E''_n = 0.7 E a_n S_3 [F_{Ln} + (1 - a_x) F_{Lx} F_{xn} S_1] \quad \ldots\ldots\ldots\ldots (3)$$

where

S_1 and S_3 correct for multiple reflections among the enclosure surfaces and are expressed as

$$S_1 = 1 \div [1 - (1 - a_x) F_{xx}]$$

$$S_3 = 1 \div [1 - (1 - a_n)(1 - a_x) F_{xn} F_{nx} S_1]$$

where

a_n = absorptivity of receiving surface for high temperature radiation.

a_x = absorptivity of the combination of all room surfaces, excluding receiver, for high temperature radiation.

F_{Ln} = shape factor of the receiving surface with respect to the radiant source. (The fraction of radiant energy leaving the source that is intercepted by the receiver).

F_{Lx} = shape factor of the combination of all room surfaces excluding the receiver with respect to the emitter. (For this particular equation the emitter is not one of the enclosure surfaces).

F_{xn} = shape factor of the receiving surface with respect to the combination.

F_{nx} = shape factor of the combination surface with respect to the receiver.

F_{xx} = shape factor of surface combination with respect to itself.

If all surfaces of an enclosure exist at approximately the same temperature, the receiving surface is expanded to include all, and the combination, x, included in Equation 3 is non-existent. For this greatly simplified case the total radiant energy reaching the enclosure from the internal source is obtained from Equation 3 as

$$E''_e = 0.7E$$

E''_e = the energy received at the enclosure surface, Btu per hour.

Equations 1 and 2 are simplified by substituting numerical values, $h_c = 0.7$, $t_a = 78$, and $t_o = 95$. (An average value of 0.7 Btu per (hr) (sq ft) (F deg) is representative for the convection coefficient over the entire enclosure surface, while the outside design and inside air temperatures are assumed to be 95 and 78 F respectively). A study of summer design conditions for a wide

section of the country and the ASHVE comfort chart justifies these assumptions. Therefore, substituting these values for h_c, t_a and t_o into Equations 1 and 2:

$$0.70\ (t_e - 78) - C_e\ (95 - t_e) = 0.70\ E \div A_t \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$(R-Q) \div A_t = 0.70(t_e - 78) + 0.24\ W \div [(95-78) \div A_t] + 0.3E \div A_t \quad \ldots\ldots (5)$$

where

A_t = total area of room surfaces, square feet. (If cooling or heating panels are absent, A_t and A_e are identical).

Equation 4 may be solved for t_e.

$$t_e = \frac{\frac{0.70E}{A_t} + 95.0C_e + 54.6}{(0.70 + C_e)}$$

A direct expression for $(R - Q)/A_t$ is obtained by substituting the preceding value of t_e into Equation 5.

$$\frac{R-Q}{A_t} = \frac{0.70\left[\frac{0.70E}{A_t} + 95.0C_e + 54.6\right]}{(0.70 + C_e)} + \frac{4.1W}{A_t} + \frac{0.3E}{A_t} - 54.6 \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

For particular values of A_t, Q, E, C_e and W obtained for the space under consideration, the heat gain R may be computed directly by Equation 6. The influence of the internal radiant source input E on R may also be considered from Equation 6, and expressed in terms of an effectiveness ratio. A convenient ratio is that of the increase in R produced solely by E, to E, and gives a dimensionless value that will be designated *Effectiveness*.

$$\text{Effectiveness} = (R_E - R_{E=0}) / E \quad \ldots\ldots\ldots (7)$$

where

R_E = value of R determined from Equation 6 for any value of E.

$R_{E=0}$ = value of R determined from Equation 6 with E equal zero.

Substitution of appropriate values for R from Equation 6 into Equation 7 results in a more useful form of Equation 7.

$$\textit{Effectiveness} = [0.49 \div (0.70 + C_e)] + 0.30 \quad \ldots\ldots\ldots\ldots (7a)$$

Equation 7a reveals that as C_e becomes infinitely large, the effectiveness approaches 0.30. Table 1 presents the enclosure surface temperature t_e, the sensible heat load, and the effectiveness at various values of E for an overall enclosure coefficient $U_e = 0.16$ and a ventilation rate of 0.175 lb per (hr) (sq ft). This ventilation rate is equivalent to approximately 0.39 cfm per sq ft.

Table 1 — Values of t_e, $(R - Q)$ and *Effectiveness* for Various Values of E when $U_e = 0.16$ and Ventilation Rate is 0.175 lb per (hr) (sq ft)

E Btu per (hr) (sq ft)	t_e Fahr	$(R-Q)$ Btu per (hr) (sq ft)	Effectiveness Percent
0	81.4	3.13	85
1	82.2	3.98	85
2	83.0	4.84	85
3	83.8	5.70	85
4	84.6	6.55	85
5	85.4	7.42	85
6	86.2	8.27	85

The application of Equation 6 and 7*a* requires that all surfaces of the enclosure be treated together as a single unit. To approximate the ideal case in practice an equivalent isothermal inside surface of the enclosure is assumed. To validate the assumption, the equivalent isothermal surface must be supported by a homogeneous equivalent wall exposed on the opposite side to a uniform temperature environment. The equivalent wall is established with a high degree of precision by taking a weighted average of the actual wall components with respect to area, overall conductance, and temperature differential. The equivalent overall coefficient is expressed in terms of the components.

$$U_e = [A_t U_t (t_t' - t_s) + A_g U_g (t_o - t_s) + A_f U_f (t_f' - t_s) + A_c U_c (t_c' - t_s) + A_w U_w (t_o' - t_s)] \div [A_t (t_o - t_s)] \quad \ldots\ldots\ldots (8)$$

where

A_t, A_g, A_f, A_c, A_w = Areas of inside partition walls, glass, floor, ceiling and outside wall respectively, square feet.

t_s, t_t', t_o, t_f', t_c', t_o' = temperatures of air inside the room, opposite inside partitions, outdoor, beneath the floor, above the ceiling and outdoor corrected for solar energy, respectively, Fahrenheit.

U_t, U_g, U_f, U_c, U_w = overall heat transfer coefficient for inside partition walls, glass, floor, ceiling and outside walls respectively, Btu per (hour) (square foot) (Fahrenheit degree difference in air temperature on both sides).

The use of a hypothetical outside temperature t_o', correcting for solar energy striking outside walls, enables a very broad application of Equation 8. The temperature t_o' is determined by writing an energy balance on the outside wall surface. This temperature is designated as the sol-air temperature and is discussed on pages 271-274 of the HEATING VENTILATING AIR CONDITIONING GUIDE, 1952. The solar transmission through glass must be included in the term Q of Equation 6. The sol-air temperature concept may also be utilized in treating thermal lag of thick walls. The equivalent conductance C_e is obtained from values of U_e computed from Equation 8.

$$1/U_e = (1/C_e) + (1/f_i) \quad \ldots\ldots (8a)$$

where

f_i = inside surface conductance Btu per (hour) (square foot) (Fahrenheit degree temperature difference).

Table 1 and Equation 7a reveal that the intensity of the lighting load has no effect on the *effectiveness*. Data are presented graphically by Fig. 1. Any problem may be accurately analyzed by applying Equations 1 and 2 to compute the exact value of the sensible cooling load R. Results clearly show that the *effectiveness* of the lighting load in heating the room is dependent on U_e and varies from 96 to 68 percent for values U_e of 0.04 and 0.48, respectively.

Operating Requirements of Cooling Panels

Rational Equations: Since a cooling panel is usually an integral part of the enclosure, it cannot be used to remove any part of the *latent* heat component, but this does not limit its ability to absorb *sensible* heat. The usefulness of cooling panels obviously becomes greater as the ratio of the sensible heat to the total heat load becomes larger, a condition which usually exists when the lighting load is appreciable. The requisite panel surface temperature may be calculated by writing a balance between the heat received and the heat lost by each surface, assuring an exact solution for the ideal case. Frequently an approximate solution will suffice, thereby shortening the

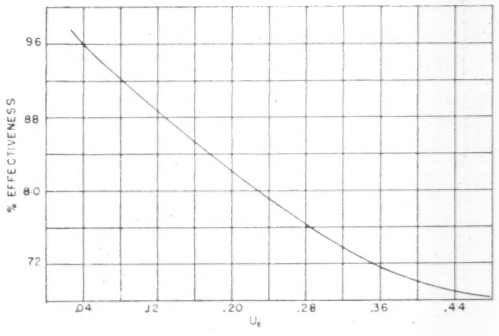

Fig. 1 — Effectiveness of lighting load in heating room air in the absence of cooling panels

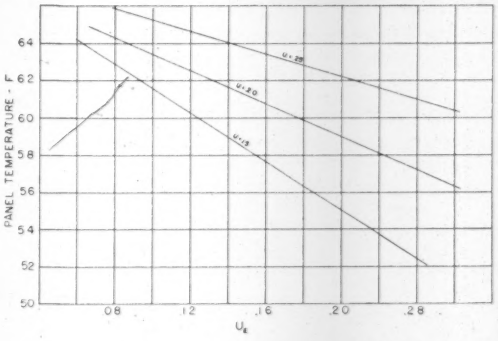

Fig. 2 — Requisite panel temperatures satisfying the comfort equation for $(R - Q) = 0$ with no lighting load

computations tremendously[3,4,5,6]. The approximate analysis is formulated by considering that all walls of the enclosure, excluding the panel, are taken as an equivalent enclosure at some hypothetically uniform temperature t_e. Equation 8 may be employed to formulate the equivalent enclosure.

By equating the energy received and lost by the equivalent enclosure surface and the room air the following relationships are respectively obtained.

$$h_r A_p F_{pe}(t_p - t_e) + h_c A_e(t_a - t_e) + E_e'' = A_e C_e (t_e - t_o)$$

$$h_c A_p (t_p - t_a) + h_c A_e (t_e - t_a) + 0.30E + (Q - R + 0.24\ W \times (t_o - t_a) = 0$$

where

h_r = radiation factor, Btu per (hour) (square foot) (Fahrenheit degree difference between the emitting and receiving surfaces).

A_p = area of cooling panel, square feet.

t_p = panel temperature, Fahrenheit.

F_{pe} = shape factor of enclosure with respect to the panel. (Value is unity for this case).

These equations are simplified by letting

$$u = A_p/(A_e + A_p)$$

and

$$v = A_e/(A_e + A_p)$$

Performing these substitutions and writing the comfort relationship (see Reference 6, p. 68), the three necessary design equations are obtained, as follows:

$$h_r u (t_p - t_e) + h_c v (t_a - t_e) + E_e''/(A_e + A_p) = vC_e (t_e - t_o) \quad \ldots\ldots\ldots\ldots (9)$$

$$h_r u (t_p - t_a) + h_c v (t_e - t_a) + [0.30E/(A_p + A_e)] + [(Q - R)/(A_p + A_e)] + [0.24\ W (t_o - t_a) \div (A_p + A_e)] = 0 \quad \ldots\ldots\ldots (10)$$

$$t_a = 140 - vt_e - ut_p \quad \ldots\ldots\ldots (11)$$

Equations 9, 10 and 11 may be applied to calculate the panel temperature required to produce *comfort*, in terms of Equation 11, for any room, provided the various heat gains are known together with wall construction. Probably the greatest concern in the application of the preceding equations is the validity of the comfort equation. Equation 11 is recommended for heating, however it probably is not as suitable for cooling[5]. A substitution of $156 - vt_e - ut_p$ for Equation 11 would likely be more accurate in defining a comfortable environment for cooling, however, the author recognizes that this proposal has not been adequately investigated. The heating relationship is used in this report in the absence of a more positive one, although the validity is recognized to be questionable in defining cooling comfort conditions.

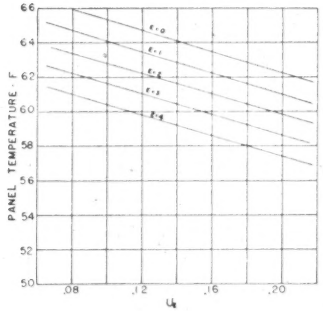

Fig. 3 — Requisite panel temperatures satisfying the comfort equation for $(R - Q) = 0$ and $u = 0.25$ for various lighting loads

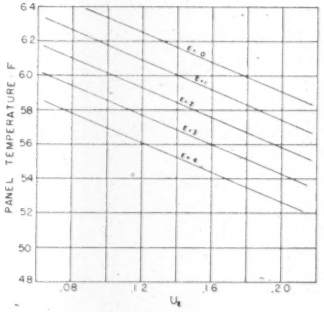

Fig. 4 — Requisite panel temperatures satisfying the comfort equation for $(R - Q) = 0$ and $u = 0.20$ for various lighting loads

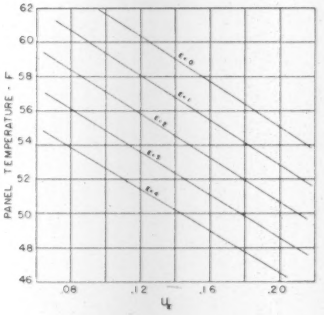

Fig. 5 — Requisite panel temperatures satisfying the comfort equation for $(R - Q) = 0$ and $u = 0.15$ for various lighting loads

The terms Q and R used in the preceding equations are the internal convective *sensible* heat gains and losses respectively, just as in Equations 2 and 5. Since an internal sink, other than the panel, must be provided to remove the latent heat, it also removes some sensible heat. Unless the direct solar load is extremely large ($Q - R$) may approach zero, but this is not a requirement for the applications of Equations 1, 2, 9, 10, and 11.

After substituting average constants for h_c and t_a, Equations 9, and 10 become 12 and 13, for a ceiling panel:

$$1.00u(t_p-t_a)+0.70v(t_a-t_a)+\frac{E_e''}{A_e+A_p}=vC_e(t_e-t_a) \quad \text{(12)}$$

In Equation 12, h_r is replaced by 1.00 since it is approximately unity for conventional wall materials and usual temperatures encountered in panel cooling.

$$\frac{R-Q}{A_p+A_e}=1.10u(t_p-t_a)+0.70v(t_e-t_a)+\frac{0.30E}{A_p+A_e}+\frac{0.24W(t_o-t_a)}{A_p+A_e} \quad \text{(13)}$$

Equation 12 may be rearranged to obtain t_e as follows:

$$t_e=\frac{ut_p+v(0.70t_a+C_et_a)+\dfrac{E_e''}{A_e+A_p}}{u+v(0.70+C_e)} \quad \text{(14)}$$

Substituting this value of t_e into Equation 13,

$$\frac{R-Q}{A_p+A_e}=1.10\ u(t_p-t_a)+0.70v\frac{\left[ut_p+v(0.70t_a+C_et_a)+\dfrac{E_e''}{A_e+A_p}\right]}{u+v(0.70+C_e)}-0.70vt_a+\frac{0.30E}{A_p+A_e}+\frac{0.24W(t_o-t_a)}{A_p+A_e} \quad \text{(15)}$$

For an inside and outside temperature of 78 and 95 F, Equation 15 becomes

$$\frac{R-Q}{A_p+A_e}=0.70v\frac{\left[ut_a+v(54.6+95.0C_e)+\dfrac{E_e''}{A_e+A_p}\right]}{u+v(0.70+C_e)}+1.10\ ut_p-85.8u-54.6v+\frac{0.30E}{A_p+A_e}+\frac{4.1W}{A_p+A_e} \quad \text{(16)}$$

By analogy with Equation 7*a*

$$\text{Effectiveness}=\frac{0.70vE_e''/E}{u+v(0.70+C_e)}+0.30 \quad \text{(17)}$$

Since E_e''/E is constant for any particular system, Equation 17 shows that the air heating effectiveness of the lighting energy is independent of panel and air temperature and the intensity.

The total sensible load of the room is given by the sum of the component R, determined by Equations 15 or 16, and the panel load. The panel load Q_p is composed of the radiant reception from the light source, the convective reception from the room air and radiation from the enclosure surfaces.

$$Q_p=E_p''+A_ph_c(t_a-t_p)+A_ph_r(t_e-t_p) \quad \text{(18)}$$

where

E_p'' is evaluated by Equation 3. The radiation factor h_r is approximately equal to unity for the surface conditions and temperature differences encountered for conventional buildings.

Applications of Equations: The evaluation of E_e'' or E_p'' from Equation 3 requires the shape factor of the enclosure or panel with respect to the light source, and this is obtained from standard charts by considering the light as a point source[3,5]. In case of several individual lights, the arithmetic average of the shape factor for each taken separately may satisfactorily be employed. All radiation from the source that is not intercepted by the panel must be received by the enclosure, therefore, $F_{Le}=1-F_{Lp}$. The absorptivity of most building surfaces is greater than 0.90 for low temperature irradiation, but the values become much less when high temperature radiation is involved, and varies appreciably with the color of the surface. An absorptivity value of 0.5 for high temperature radiation is characteristic of a surface painted with a light colored flat paint, but is low for special heat absorbing paints which are useful in increasing the panel effectiveness relative to the removal of lighting loads.[1]

Fig. 2 shows the required panel surface temperature for three values of u, ratio of panel area to total area, as a function of the equivalent overall conductance. These curves are obtained by application of Equations 9, 10, 11, with $(Q-R)$, t_o, and W taken as 0 Btu per (hr) (sq ft) (F deg), 95 F, and 0.175 lb per (hr) (sq ft) respectively. The outside design air temperature selected is applicable to most localities in the eastern part of the United States and the ventilation rate is representative of approximately one air change per hour. No allowance is made for the effect of solar radiation on the outside surfaces. For these conditions Figs. 3, 4, and 5 show graphically the requisite panel surface temperature as a function of U_e for u = 0.25, 0.20, and 0.15 respectively, each for a lighting load of 0, 1, 2, 3, and 4 Btu per (hr) (sq ft). Although these charts are somewhat limited, they are constructed to be used for design purposes when the actual conditions simulate those for which they are prepared. A value of $E_e''=0.47\ E$ and $0.35\ E$ may be used for design purposes for a conventional room with a panel absorptivity of 0.5 and 0.8 respectively, a shape factor of 0.5 between the light

source and the panel, and an enclosure absorptivity of 0.5. The value approaches zero as the panel absorptivity and shape factor from the source to panel simultaneously approach unity.

The following example illustrates the application of the various equations: A room 14 x 16 x 9 ft contains a cooling panel occupying the entire ceiling with the absorptivity of all surfaces including the panel equal to 0.9 and 0.5 for low and high temperature radiation respectively. For an outside dry bulb temperature of 95 F, an inside air temperature of 78 F, a panel temperature of 66 F, an internal gain of 2500 Btu per hr, a lighting load of 575 watts and an equivalent conductance of 0.08 Btu per (hr) (sq ft) (F deg), calculate (*a*) the required sensible sink R, (*b*) total panel load and (*c*) effectiveness of lighting load. The shape factor of the panel with respect to the light is assumed as 0.5. The inside air temperature given is not necessarily in accordance with Equation 11.

Solution:

A_p = 224 sq ft
A_c = 764 sq ft
A_t = 988 sq ft
u = 0.227
v = 0.773
t_c = 78.5 (by Equation 14)
(*a*) R = 435 Btu per hr by Equation 15 or 16
(*b*) Q_p = 455 + 2960 + .2800 = 6215 Btu per hr (by Equation 18)

The first term, E_p'' in Equation 18 will be 0.23 E computed by Equation 3.

Sensible load = $R + Q_p$ = 6650 Btu per hr.

Total load = $Q_s + Q_l$ = 6650 + Q_l Btu per hr.

(*c*) Percent Effectiveness = 60 percent by Equation 17.

Applications of Charts

The use of the charts, Figs. 3, 4 and 5, may be demonstrated with the following example: A room 14 x 16 x 9 ft possessing an overall equivalent conductance, U_c = 0.16 is located in an area where the design outside air temperature is 95 F. The room contains 1000 watts of electric incandescent lighting and is to be cooled with a panel covering the entire ceiling. What is the requisite surface temperature?

Solution: Since the charts are constructed for only one ventilation rate, this factor does not enter into the graphical solution. The lighting load per square foot is (1000 × 3.42)/988 = 3.47 Btu per (hr) (sq ft) and u = 224/988 = 0.227. This requires interpolation between L = 3.0 and 4.0 and between u = 0.200 and 0.250. A panel temperature of 57.2 F is determined. If no lighting load were present, the requisite panel temperature would have been 62.0 F. Although the graphical solution is limited, it is useful in securing relatively close approximations and evaluating trends produced by changing conditions. Figs. 3, 4, and 5 are based on a shape factor from the light to the panel of 0.5 and an absorptivity value for all surfaces equal 0.5.

Summary of Cooling Panel Performance

The effectiveness of the panel in removing internal radiation may be significantly improved by increasing either the shape factor, with respect to the source, the surface absorptivity, or both. In some cases panel surfaces with a special heat absorbing paint possess absorptivity values as high as 0.80. For a shape factor of the panel with respect to the light equal to 0.5 and an enclosure absorptivity of 0.5, a panel absorptivity of 0.5 and 0.8 produces a respective approximate direct absorption of 23 and 37 percent of the filament input. [6] Direct absorption as used here includes energy exchanged between the panel and source plus that received by the panel by reflection. Reradiation of energy from enclosure surfaces is not included. These quantities are determined by Equation 3 and are independent of the panel temperature. If the panel temperature is equal to the air temperature, no convection transfer is possible but a net transfer by radiation occurs between the panel and the warmer enclosure surfaces. Energy lost from the warm surface walls reduces convection to the room air thereby reducing the convective component R. The temperature of the inside enclosure surfaces is dependent on the equivalent conductance as well as the temperature on the weather side, and is usually several degrees warmer than the inside air. The rate of radiant energy absorption by the panel from the enclosure surfaces is equal to approximately 1 Btu per (hr) (F deg difference between surfaces) (sq ft of panel area). Irrespective of whether this energy is received at the enclosure by radiation from lights or by conduction from the outside, its removal by radiation represents a decrease in the convective sensible cooling component R.

By reducing the panel temperature below that of the ambient air, heat removal by convection from the room air results, ranging from approximately 0.4 to 1.1 Btu per (hr) (sq ft) (F deg) for floor and ceiling panels respectively. As depicted by Equation 18, the overall cooling capacity of the panel increases as its temperature is lowered, but because

F. PAUL ANDERSON AWARD

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of possible condensation, the panel temperature cannot be brought too near the dew point of the room air. Except for extreme cases, cooling panels may be designed to accommodate all the sensible component, a condition representing maximum performance. This condition would be determined by making R equal to zero in Equations 15 or 16, locating the panel temperature safely above the dew point, and solving for the requisite area. As some provisions must be made for the removal of the latent component, a portion of the sensible load is simultaneously removed revealing that an arbitrary selection of R equal zero is not necessarily the most feasible selection. Consequently the most logical design is probably the determination of R associated with the latent heat sink, and the corresponding panel area and temperature as given by Equation 15 or 16.

Conclusions

1. All of the lighting loads should not be considered in calculating the cooling capacity required for convective cooling. In the absence of cooling panels the value to be considered varies from approximately 96 percent for a very well insulated enclosure to approximately 68 percent for a very poorly insulated one.

2. A cooling panel intercepting one half of the radiation from a light source, directly absorbs approximately 23 and 37 percent of the electrical input to the lights when the enclosure surfaces possess an absorptivity value of 0.5 with a panel absorptivity of 0.5 and 0.8 respectively. These values are independent of the panel temperature. By use of a panel at a temperature no lower than that of the room air an additional increase in energy removal is achieved by radiation between the enclosure surface and the panel. This component is equal to approximately 1 Btu per (hr) (F deg) for each square foot of panel surface. The effectiveness of the lighting load in heating the air is independent of panel surface temperature, and decreases with the equivalent conductance, panel absorptivity, and the light to panel shape factor.

3. Simplified equations are given from which the panel temperature, room air temperature, and enclosure temperature may be determined in accordance with the comfort equation (see Equations 9, 10, 11). Furthermore Equation 15 may be used to calculate the additional sensible heat removal R necessary to maintain equilibrium for a given panel and room air temperature, or the required panel temperature for known values of the air temperature and R. Equations 15 and 18 give the total load requirements.

Acknowledgment

The author wishes to thank the following members of the spring semester 1951 class of ME 203b, a graduate course in panel heating and cooling, for their appropriate suggestions and also for valuable aid in checking calculations: S. E. Fowlkes, W. K. Greathouse, J. W. Hamilton, A. M. Levy, and R. E. Manuel.

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4. Removal of Internal Radiation by Cooling Panels, Merl Baker (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, November 1949, p. 105).

5. Panel Heating and Cooling Analysis, by B. F. Raber and F. W. Hutchinson (John Wiley and Sons, Inc., New York, 1947).

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7. Simplifying Calculation for Exchange of Radiant Heat, B. F. Raber and F. W. Hutchinson (*Heating, Piping & Air Conditioning*, September 1944, p. 530).

8. A Single Equation Design Procedure for Radiant Panel Systems, F. W. Hutchinson (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December 1945, p. 637).

9. Influence of Gaseous Radiation in Panel Heating, F. W. Hutchinson (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, November 1946, p. 103).

10. Sol Air Temperature—New Concept, C. O. Mackey (*Heating and Ventilating*, December 1944, p. 62).

11. Design Factors in Panel and Air Cooling Systems, C. S. Leopold (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1951, p. 115).

PAPERS FOR FUTURE PROGRAMS

The Program and Papers Committee is desirous of securing papers for consideration by the Publication Committee, so that interesting and varied programs of technical subjects can be presented at Society Meetings.

Among the subjects of current interest to the membership are the following:

1. Air Cleaning in Ventilation
2. Odors and Odor Control
3. Heat Pump
4. Noise Control
5. Performance of Outlets (Air Distribution)
6. Influence of Humidity (Comfort and Health)
7. Influence of Radiation (Comfort and Health)
8. Panel or Radiant Heating
9. Panel or Radiant Cooling
10. Air Sterilization
11. Influence of Radiation (Comfort and Health)

There are, of course, other subjects on which papers will be welcome, so they need not necessarily be confined to those listed.

ASHVE members are cordially invited to submit papers for review. Papers having joint authorship will be acceptable. Manuscripts received by September 1, 1952, will receive consideration for the 59th Annual Meeting presentation in Chicago. Any member intending to submit a paper, should notify the Executive Secretary of the Society at the headquarters office, 62 Worth St., New York 13, N. Y., who will furnish the detailed information regarding preparation and submission of manuscript.

PROGRAM AND PAPERS COMMITTEE
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The Shading of Sunlit Glass

An Analysis of the Effect of Uniformly Spaced Flat Opaque Slats

By G. V. Parmelee* and W. W. Aubele**, Cleveland, Ohio

This paper is the result of research carried on by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS at its Research Laboratory located at 7218 Euclid Avenue, Cleveland 3, Ohio

SUMMARY — This paper presents the results of an analytical investigation of the transmission, absorption and reflection of solar radiation by uniformly spaced opaque flat slats, important examples of which are venetian blinds, certain types of jalousies, and several types of sun screen that are in common use. The results also apply to multiple shading fins that may be incorporated as a more or less permanent part of a structure. This investigation parallels an experimental program which has been carried on to check the analytical treatment and to provide important information which cannot be readily developed analytically. The results of the experimental work will be reported in a subsequent paper.

The present paper expresses the reflectance, transmittance, and absorptance of a slat assembly in terms of the profile angle, the solar absorptivity of the slat surface, and the geometry of the slat assembly. The geometry includes the angle at which the slats are set, the slat-width-spacing ratio, and the slat thickness-spacing ratio.

Transmittance and absorptance curves are given for the entire range in profile angle and surface absorptivity, and for slat geometry which covers the range most used in slat-type shades. Both diffuse and specular reflecting surfaces are considered. Means of interpolation are provided.

Some data on the solar absorptivity of slat surfaces are given. The application of the results to the determination of sun shading effects is illustrated. Development of the basic formulas and auxiliary data are given in the form of appendixes.

THIS PAPER presents the results of one phase of an investigation of the effect of shades on heat flow through sunlit glass. It is concerned only with slat-type shades, such as venetian blinds, sun screens, and jalousies. The immediate objectives are: (1) the determination of the absorbing, reflecting, and transmitting characteristics of slat-type shades for solar radiation; and (2) the determination of the influence of slat-type shades on room heat gain by convection and re-radiation from sunlit glass. The final objective of this study is the determination of shading factors to apply to published design data for unshaded glass.[1]

The investigation has proceeded under the direction of the Technical Advisory Committee on Heat Flow Through Glass† along two parallel paths of which the first is a mathematical analysis of the first objective. The results of this analysis are reported in this paper. The second path is the one of experiment. Tests are being conducted to check the mathematical analysis for a very limited number of cases and to provide data pertinent to the second objective. The experimental findings will be included in later reports.

Analysis of Problem

An assembly of slats such as a venetian blind which is partly open, absorbs, reflects or transmits solar radiation which falls upon it. Each of these components can be computed by means of equations which give the relationship between the following factors:

1. The manner in which the slat surface reflects the incident radiation and the fraction of this radiation which the surface absorbs.
2. The profile angle of the incident solar beam.
3. The geometry of the slat assembly.

Two types of surfaces are treated in this paper, those which reflect specularly, like a mirror, and those which are perfectly diffusing reflectors. Though many practical surfaces are neither wholly specular nor wholly diffuse reflectors, their reflected radiation can be separated approximately into these two components.

Specular Reflecting Surfaces

Consider the slat system illustrated in diagram 1a of Fig. 1. The absorptance of the slat *surface* is designated by α. The reflectance of the slat *surface* is therefore $(1-\alpha)$. In this case the incident beam can be divided into three fractions. Of fraction f_1, $(1-\alpha)$ is reflected away from the slats and α is absorbed. Fraction f_2 undergoes four reflections before emerging from the slat assembly reduced by $(1-\alpha)^4$. Fraction f_3

*Research Associate, ASHVE Research Laboratory. Member of ASHVE.

**Research Engineer, ASHVE Research Laboratory.

For presentation at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Spring Lake, N. J., June 1952.

[1] Exponent numerals refer to References.

†Personnel: R. A. Miller, *Chairman*; N. B. Hutcheon, *Vice Chairman*; W. J. Arner, F. L. Bishop, E. W. Conover, D. D'Eustachio, W. B. Ewing, J. E. Frazier, J. S. Herbert, R. W. McKinley, E. C. Miles, D. R. Muir, F. W. Preston, Vic Sanders, H. B. Vincent, J. R. Young.

passes through reduced by $(1-\alpha)^2$. Under certain conditions part or all of the incident beam may pass through the slats without striking the slat surfaces.

Diffuse Reflecting Surfaces

Consider now diagram 1b of Fig. 1, which illustrates a system of slats which are perfectly diffusing reflectors. Fraction m/W of slat surface 1 is uniformly radiated by the incident beam; $(1-\alpha)$ is reflected. Part of this radiation is reflected away from the slats, a small part is reflected through the opening between the slats, and the remainder is reflected to slat surface 2. The proportions of each reflected quantity depend upon the position of point P_1 (*Note*: the length of the arrows represents the intensity of the beam in the direction of the arrow). The radiation which arrives at surface 2 (*non-uniformly distributed*) is reflected in similar fashion as illustrated by that which leaves point P_2.

*The Profile Angle**

The profile angle ϕ is the sun angle that controls the performance of a given slat assembly in that it determines the position of the shadow line cast on one slat by the slat between it and the sun. It is defined in the following way: Pass a plane through the plane of the slat assembly so that it is perpendicular to this plane and so that the intersection of the two planes is parallel to the length of that slat. Now rotate this plane until it includes the position of the sun. The angle through which the plane has been rotated is the profile angle. The profile angle is illustrated in Fig. 2 for slat assemblies in which the long dimension of the slat is horizontal.

The relationship between the profile angle ϕ, the solar altitude β, and the solar azimuth γ, for a slat assembly of which the plane is vertical and the slats run horizontally (the most common arrangement) is given by Equation 1 and Fig. 3 —

$$\tan \phi_{v,h} = \tan \beta / \cos \gamma \quad \ldots\ldots (1)$$

If the slat assembly is inclined ω degrees from the vertical, then

$$\phi_{i,h} = \phi_{v,h} \pm \omega \quad \ldots\ldots (2)$$

If the slat assembly plane is vertical and the long dimension of the slats is also vertical then

$$\phi_{v,v} = \gamma \quad \ldots\ldots (3)$$

Finally, if the slat assembly plane is inclined and the long dimension is also inclined, then

$$\tan \phi_{i,i} = (\cos \phi_{v,h} \tan \gamma) \div \cos \phi_{i,h} \quad \ldots\ldots (4)$$

The first subscript on ϕ refers to the plane of the slat assembly and the second refers to the direction of the long dimension of the slat; $_{v, i, h}$ designate vertical, inclined and horizontal respectively.

The profile angle ϕ is positive and has values from 0 to + 90 deg when it is measured clockwise from reference line 0 – X (see Fig. 1). It is negative and has values from 0 to — 90 deg when measured counterclockwise from the reference line.

Geometry of a Slat Assembly

The geometry of a slat assembly is defined by the slat width-slat spacing ratio W/S the slat thickness-slat spacing ratio D/S and the slat angle ψ. The slat angle is measured as shown in Fig. 1, is always considered as having a positive sign, and may have any value between 0 and 90 deg. With this limitation all possible angular relationships between the slat angle ψ and the profile angle ϕ can be covered by allowing ϕ to be either positive or negative.

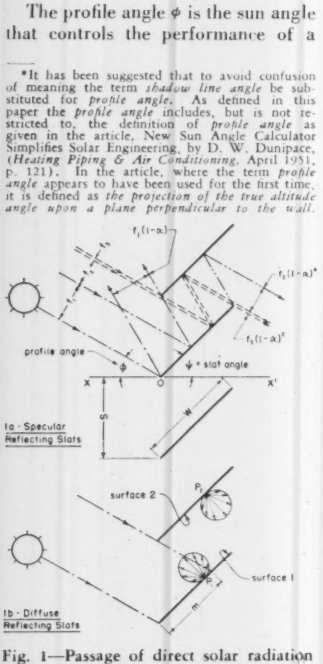
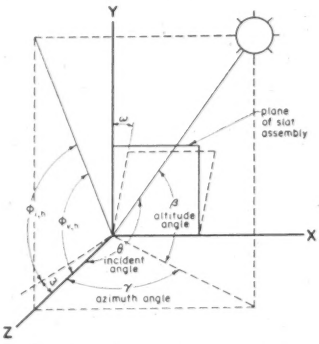


Fig. 1—Passage of direct solar radiation through systems of specular reflecting slats and diffuse reflecting slats



$\Phi_{v,h}$ = profile angle: plane of slat assembly vertical; slats run horizontally

$\Phi_{i,h}$ = profile angle: plane of slat assembly inclined; slats run horizontally

Fig. 2—Definition of angles

Characteristics of Practical Slat Assemblies

Absorptance of Slat Surface

A number of slat assemblies, varied as to slat angle, spacing ratio, slat width, and type and color of surface are being investigated at the ASHVE Research Laboratory. The spectral absorptance characteristics of these surfaces are given in Fig. 4. It is evident that almost any absorptance value might be found in practice. Curves A, B, and C are for surfaces which are predominately diffuse reflectors while curve D is for a surface which is entirely a specular reflector.

Slat Geometry

A study of general practices in the venetian blind industry shows that W/S values range from 1.19 to 1.27. By far the most common is a value of 1.23 for 2-in. wide slats spaced 1⅝ in. on centers. The thickness ratio for metal slats, 0.007, is negligibly small. The slat angle ψ is adjustable.

Shade screens usually have fixed slats which vary in width between about 1/16 and ⅛ in. The spacing ratio varies from about 0.8 to 1.0. With these small slats thickness ratios are significant and range from about 0.10 to 0.15. Slat angles vary from about 15 to 30 deg in designs presently known.

*It has been suggested that to avoid confusion of meaning the term *shadow line angle* be substituted for *profile angle*. As defined in this paper the *profile angle* includes, but is not restricted to, the definition of *profile angle* as given in the article, New Sun Angle Calculator Simplifies Solar Engineering, by D. W. Dunipace, (*Heating Piping & Air Conditioning*, April 1951, p. 121). In the article, where the term *profile angle* appears to have been used for the first time, it is defined as *the projection of the true altitude angle upon a plane perpendicular to the wall.*

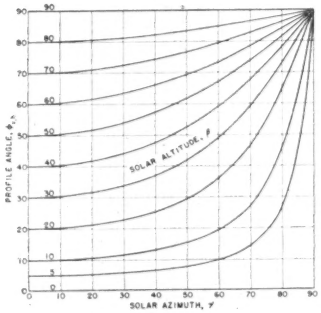


Fig. 3—Profile angle $\phi_{T,h}$, for a vertical slat assembly with long dimension of slats horizontal

Calculated Values of Absorptance, Reflectance and Transmittance

Direct Solar Radiation

Calculated values of absorptance A_D and transmittance T_D for direct solar radiation are given in Figs. 5, 6 and 7 for specular reflecting slat surfaces and Figs. 8, 9 and 10 for diffuse reflecting slat surfaces. These curves are for flat opaque slats with negligible thickness ratio D/S for positive values of ϕ and for slat assemblies large enough in area so that edge effects are negligible. Moreover, they are strictly applicable only to monochromatic radiation. Derivations of the equations from which these curves were plotted are given in Appendixes A and B.

In each case the transmittance curves run from the upper left of the figure to the lower right and the absorptance curves run from lower left to upper right. The reflectance of the assembly R_D is given by the relationship

$$R_D = 1 - A_D - T_D \quad \ldots\ldots\ldots (5)$$

The following points with respect to the curves for specular reflecting slat surfaces should be noted:

In Fig. 5 the curves of T_D for $W/S = 0.6$ and of A_D for $W/S = 1.2$ have been omitted but the values can be found readily from the relationship that $T_D = 1 - A_D$ when $\psi = 0$, since under this condition, $R_D = 0$.

In Figs. 6 and 7 when ϕ is greater than $(90 - \psi)$, $T_D = 0$ and $A_D = \alpha$ except when $\psi = 45$ deg with $W/S = 0.6$. Here the limiting condition is $\phi =$ about 54 deg.

Nomenclature

α = absorptance of slat *surface* for solar radiation, dimensionless.

α_D, α_d = absorptance of a glass section for direct and diffuse solar radiation respectively, dimensionless.

β = altitude of the sun above a horizontal plane, degrees.

γ = azimuth of the sun with respect to the perpendicular to a vertical wall, degrees.

θ = angle of incidence; angle between the sun's rays and a perpendicular to a surface, degrees.

$\rho = 1 - \alpha$ = reflectance of a slat *surface* for solar radiation, dimensionless.

ρ_D, ρ_d = reflectance of a glass section for direct and diffuse solar radiation respectively, dimensionless.

τ_D, τ_d = transmittance of a glass section for direct and diffuse solar radiation, respectively, dimensionless.

ϕ = profile angle, degrees (see Figs. 1 and 2).

ψ = slat angle, degrees (see Fig. 1).

ω = inclination angle of the plane of the slat assembly measured with respect to a vertical surface, degrees.

A_D, A_d = absorptance of a slat *assembly* for direct and diffuse solar radiation respectively, dimensionless.

D = slat thickness, inches.

L = opening ratio, the fraction of the incident direct radiation which passes directly through the slat assembly.

m = slat width irradiated by the sun, inches.

R_D, R_d = reflectance of slat *assembly* for direct and diffuse solar radiation respectively, dimensionless.

S = slat spacing, inches.

T_D, T_d = transmittance of slat *assembly* for direct and diffuse solar radiation respectively, dimensionless.

W = slat width, inches.

W/S = ratio, slat width to spacing.

D/S = ratio, slat thickness to spacing.

It should be understood that Figs. 5 to 10 express the performance of slat-assemblies only. The transmittance and absorptance of a glass-slat assembly combination will be discussed in a later section of the paper. Corrections to apply when D/S is not negligible, are treated in Appendix A.

The Opening Ratio, L

The opening ratio, L, is defined as the width of that portion of the opening between the slats through which direct radiation passes without striking the slats, divided by the slat spacing. For example, in Fig. 6 when $\alpha = 1.0$ and $\phi = 10$ deg, the transmittance, T_D, of a slat assembly with $W/S = 1.2$ is 0.22. This fraction, and all such fractions for $\alpha = 1.0$, is the opening ratio. Geometrically, for positive values of ϕ, and for negative values of ϕ such that $(-\phi)$ is less than ψ,

$$L = 1 - (W/S\ [\sin(\phi + \psi)] \div \cos\phi \quad \ldots\ldots\ldots (6)$$

and for negative values of ϕ, where $(-\phi)$ is equal to or greater than ψ

$$L = 1 + (W/S)\ [\sin(\phi + \psi)] \div \cos\phi \quad \ldots\ldots\ldots (7)$$

These relationships are plotted in Fig. 11 and are useful in interpolation. The minimum value of L is 0; therefore, negative values have no significance. Note that for $\phi = \psi = 0$ and for negative values of ϕ such that $(-\phi) = \psi$, the opening ratio is unity.

Diffuse Solar Radiation

The curves of Figs. 5 to 10 can be used to calculate the absorptance and

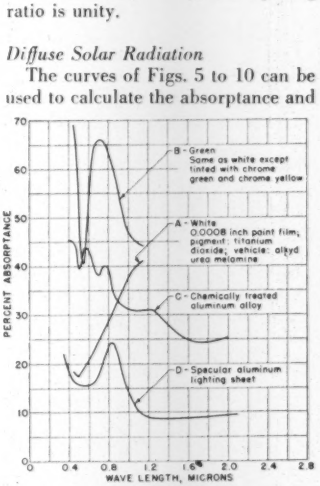

B - Green
Same as white except tinted with chrome green and chrome yellow
A - White
0.00008 inch paint film; pigment: titanium dioxide; vehicle: alkyd urea melamine
C - Chemically treated aluminum alloy
D - Specular aluminum lighting sheet
PERCENT ABSORPTANCE
WAVE LENGTH, MICRONS

Fig. 4—Spectral absorptance of various materials used in slat-type shading devices

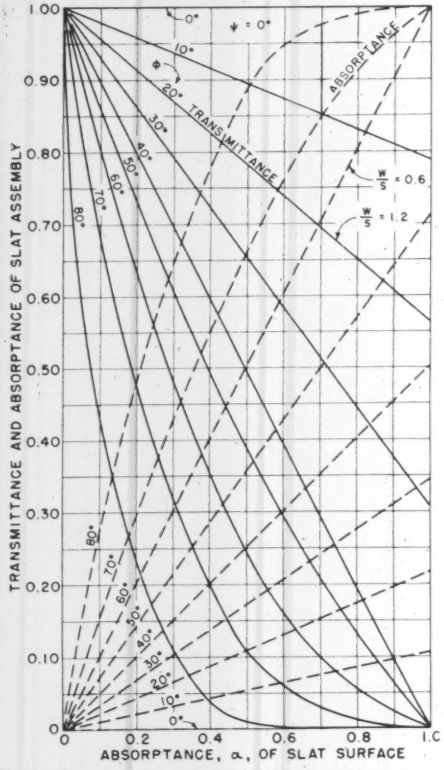


Fig. 5—Transmittance and absorptance of specular reflecting slats for monochromatic radiation

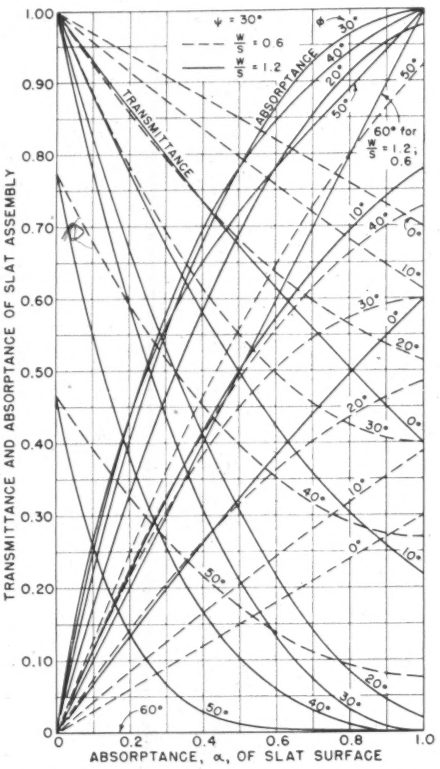


Fig. 6—Transmittance and absorptance of specular reflecting slats for monochromatic radiation

transmittance of incident diffuse solar radiation by a slat assembly. The principal source of diffuse solar radiation, the sky, appears as a quarter sphere to an observer. Consider one half of the quarter spherical surface. This can be divided into 81 patches such that the center of each patch differs by 10 deg in altitude and azimuth from the center of an adjacent patch. The total diffuse radiant energy, I_d, which falls upon a vertical surface, such as a slat-type shade, from these patches is

$$I_d = 2 \sum_{n=1}^{n=81} I_n A_n \cos\theta_n \quad \text{.....(8)}$$

The radiant energy transmitted by the shade is

$$I_d T_d = 2 \sum_{n=1}^{n=81} I_n A_n \cos\theta_n T_{\theta_n} \quad \text{.....(9)}$$

where I, A, $\cos\theta$ and T_θ are respectively the intensity of radiation from the patch, the patch area, the cosine of the incident angle corresponding to the altitude and azimuth associated with the patch, and the transmittance of the slat for direct radiation associated with the profile angle of the radiant beam from the patch.

The transmittance, T_d, of the slat assembly for diffuse solar radiation is, therefore,

$$T_d = \frac{\sum_{n=1}^{n=81} I_n A_n \cos\theta T_{\theta_n}}{\sum_{n=1}^{n=81} I_n A_n \cos\theta_n} \quad \text{.....(10)}$$

The absorptance, A_d can be calculated in similar fashion. Calculations for a sky of uniform intensity have been carried out for several cases with results as shown in Table 1. Calculations for a non-uniform sky were also made for the diffuse reflecting slat assembly with $\alpha = 0.37$. These were based upon the brightness distribution[2] of a clear sky with 40 deg solar altitude. The azimuth of the sun with respect to the orientation of the slat plane was 180 deg. The result was a 10 percent increase in T_d. Ground reflected solar radiation can be significant and treated in the manner indicated by Equation 10.

Transmittance and Absorptance of a Combination of Glass and a Slat Assembly

The transmittance of a slat-glass combination is complicated by the

effect of reflections between the two elements of the combination and cannot be simply treated. For rough estimates of the behavior of a combination of glass and a slat assembly, the following rules apply:

1. The transmittance of the combination is the product of the transmittances of the separate components.

2. The absorptance of the outdoor component is that of the outdoor component alone.

3. The absorptance of the indoor component is the product of the transmittance of the outdoor component, and the absorptance of the indoor component.

If reflections were taken into account, the results would have to be multiplied by a factor greater than one. The treatment of one pair of reflections, usually the only pair of significance, is given in Appendix C for flat glass in combination with a slat assembly. Transmittance and

Table 1—Calculated Values of Absorptance, A_s, and Transmittance, T_d, of Diffuse Solar Radiation by Slat-Type Shades

Absorptance of Slat Surface, α	Type of Reflection	Slat Width Spacing Ratio W/S	Slat Angle ψ	Absorptance A_s	Transmittance T_d
0.16	Specular	1.2	30	0.25	0.52
0.37	Specular	1.2	30	0.51	0.33
0.37	Diffuse	1.2	30	0.45	0.20

Table 2—Comparison of Diffuse and Specular Reflecting Slats for the Same Values of Slat Surface Absorptance and Slat Geometry

Type of Reflection	Slat Width-Spacing Ratio, W/S	Surface Absorptance α	Slat Angle ψ	Profile Angle ϕ	Transmittance T_D	Absorptance A_D	Reflectance R_D
Specular	1.2	0.4	30	20	0.42	0.58	0.00
Diffuse	1.2	0.4	30	20	0.17	0.52	0.31
Specular	1.2	0.4	30	60	0.00	0.40	0.60
Diffuse	1.2	0.4	30	60	0.09	0.49	0.42
Specular	0.6	0.4	30	20	0.74	0.26	0.00
Diffuse	0.6	0.4	30	20	0.59	0.23	0.18
Specular	1.2	0.4	0	20	0.83	0.17	0.00
Diffuse	1.2	0.4	0	20	0.66	0.25	0.09
Specular	1.2	0.4	45	20	0.19	0.59	0.22
Diffuse	1.2	0.4	45	20	0.10	0.51	0.39
Specular	1.2	0.2	45	20	0.37	0.34	0.29
Diffuse	1.2	0.2	45	20	0.17	0.28	0.55
Specular	1.2	0.2	45	60	0.00	0.20	0.80
Diffuse	1.2	0.2	45	60	0.10	0.25	0.65

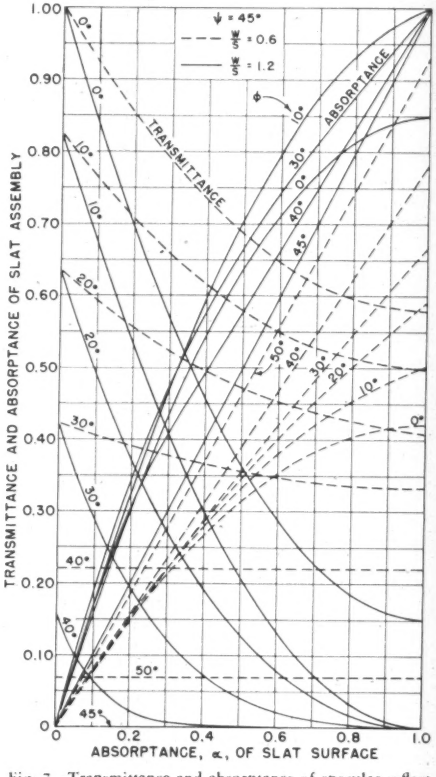


Fig. 7—Transmittance and absorptance of specular reflecting slats for monochromatic radiation

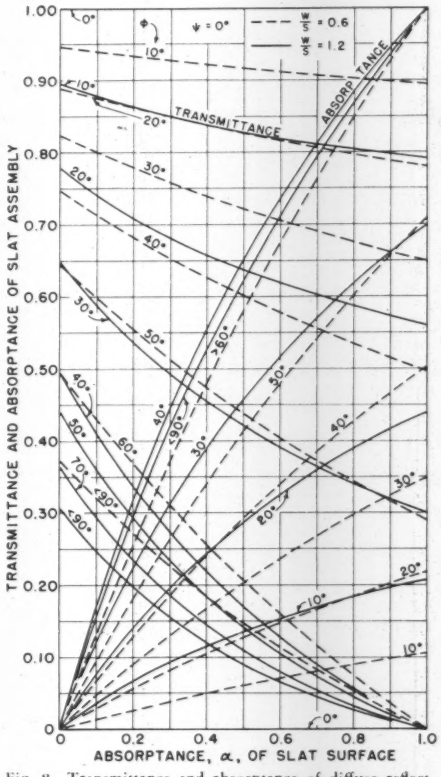


Fig. 8—Transmittance and absorptance of diffuse reflecting slats for monochromatic radiation

absorptance values for flat glass have been summarized in an ASHVE Research paper[3].

Applications

Instantaneous heat gain through a sunlit glazed opening which is provided with a shade consists of two components:

1. The gain which results from the transmission of direct and diffuse solar radiation by the shade-glass combination.

2. The gain which results from the solar radiation absorbed by the shade and by the glass. This gain is influenced by location of the shade (indoors or outdoors), the division of absorbed radiation between the shade and the glass, the indoor and outdoor temperatures, emissivity of the shade, and other factors.

The magnitude of the first component is dependent upon the solar intensity, the profile angle, the slat geometry and the slat surface absorptance, and can be estimated with good precision from the data given in this paper. Only the first step, however, can be taken in estimating the magnitude of the second component. *This limitation of the present paper should be clearly recognized.* Experimental work is required in order to relate absorbed solar energy to heat gain. Such work is now in progress.

The application of the curves will be illustrated by the following example:

Example: A venetian blind with horizontal slats is installed on the inside of ordinary window glass set in a southwest wall at 40 deg north latitude. The time is 2:00 p.m. on August 1. Find the solar radiation (1) transmitted by the slat-glass combination, (2) absorbed by the glass, and (3) absorbed by the shade. $\psi = 30$ deg, $W/S = 1.2$, $\alpha = 0.37$, the slat surface is a diffuse reflector. Disregard the shading effect of the window reveal and the effect of reflections between the shade and the glass.

Solution:

From Table 7, p. 270, THE GUIDE 1952: $\beta = 56$ deg, $\gamma = 14$ deg

From Table 6, p. 269, THE GUIDE 1952: $\cos\theta = K = 0.542$, from which $\theta = 57.2$ deg

From Table 5, p. 267, THE GUIDE 1952: $I_{Dn} = 279$, $I_d = 28.1$ Btu per (hr) (sq ft)

The incident direct radiation $= \cos\theta \times I_{Dn} = 0.542 \times 279 = 151.2$ Btu per (hr) (sq ft)

From Table 15, p. 288, THE GUIDE 1952: $r_D = 0.804$, $r_d = 0.79$, $\alpha_D = 0.06$, $\alpha_d = 0.06$

From Fig. 3 (this paper): $\phi = 56$ deg

From Fig. 9 (this paper): $T_D = 0.105$, $A_D = 0.47$

From Table 1 (this paper): $T_d = 0.20$, $A_d = 0.45$

The radiation transmitted by the shade-glass combination is

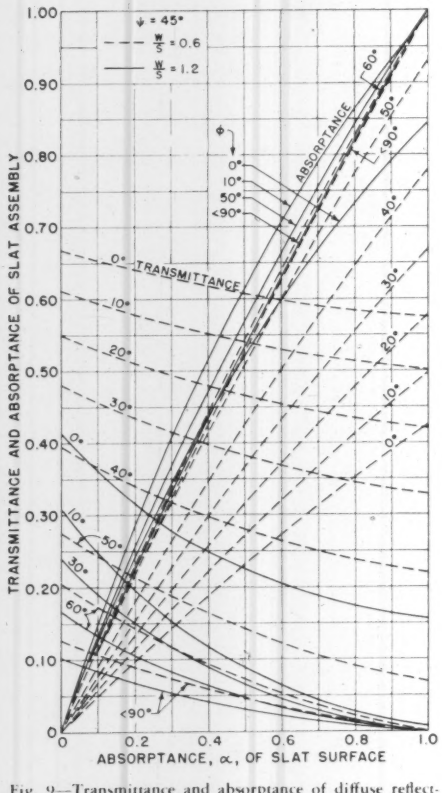


Fig. 9—Transmittance and absorptance of diffuse reflecting slats for monochromatic radiation

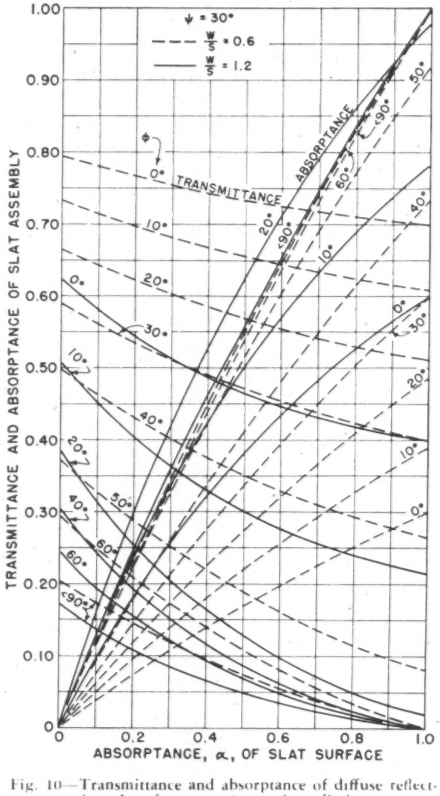


Fig. 10—Transmittance and absorptance of diffuse reflecting slats for monochromatic radiation

$q_{T_{sg}} = 0.804 \times 0.105 \times 151.2 + 0.79 \times 0.20 \times 28.1 = 12.8 + 4.4 = 17.2$ Btu per (hr) (sq ft)

The radiation absorbed by the glass and by the shade respectively are,

$q_{A_g} = 0.06\ (151.2 + 28.1) = 10.8$ Btu per (hr) (sq ft)

$q_{A_s} = 0.804 \times 0.47 \times 151.2 + 0.79 \times 0.45 \times 28.1 = 57.2 + 10.0 = 67.2$ Btu per (hr) (sq ft)

Conclusions

A study of the curve families allows some general conclusions to be made regarding the effect of the several variables on the performance of a slat-type shade. Selected values are given in Table 2 to illustrate these conclusions. Except as noted the conclusions apply to positive values of the profile angle, ϕ.

1. For given values of slat absorptance α and profile angle ϕ, and slat geometry, the type of reflection (diffuse or specular) is most important. The importance decreases as profile angle ϕ, slat angle ψ, and slat width-spacing ratio W/S, decrease.

2. For a given profile angle and slat geometry, decreasing values of α increase reflectance but also increase transmittance.

3. In many cases, particularly when W/S is of the order of 1.2 and ψ is greater than 0, the absorptance of the *slat assembly* is greater in value than the absorptance value of the slat *surface*.

4. For specular reflecting slats when $(\phi + \psi)$ is less than 90 deg, the following approximate generalization seems to hold: diffuse reflecting slats transmit less, reflect more and absorb about the same amount as specular reflecting slats for the same value of α. For values of $(\phi + \psi)$ greater than 90 deg, diffuse reflecting slats transmit more, absorb more, and reflect less.

5. When $(\phi + 2\psi)$ is less than 90 deg, specular reflecting slats reflect no radiation away from the slats.

6. When $(\phi + \psi)$ is greater than 90 deg, specular reflecting slats transmit no radiation; $A_D = \alpha$ and $T_D = 1 - \alpha$, as long as L, the opening ratio $= 0$.

7. When ψ is 0 or ϕ is negative, such that $-(\phi) > \psi$, specular reflecting slats under no conditions reflect radiation away from the slats.

References

1. Heating, Ventilating, Air Conditioning Guide 1952 (published by The American Society of Heating and Ventilating Engineers, New York, N. Y.).

2. Recommended Practice of Daylighting, by the Daylighting Committee of the *Illuminating Engineering Society* (*Illuminating Engineering*, Vol. 45, No. 2, February 1950, p. 129).

3. ASHVE Research Report — Heat Flow Through Unshaded Glass — Design Data for Use in Load Calculations, by G. V. Parmelee and W. W. Aubele (ASHVE Journal Section, *Heating, Piping & Air Conditioning*, June 1950, p. 131).

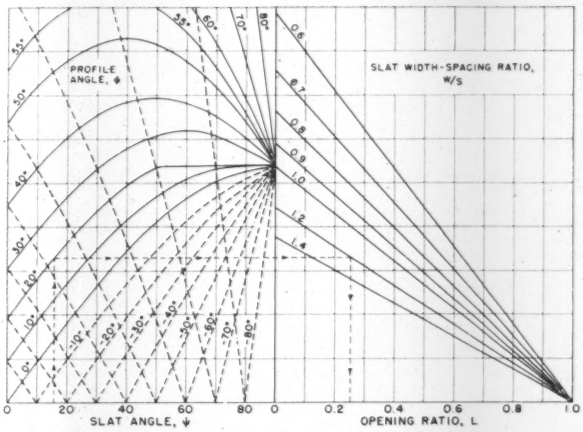


Fig. 11—Opening ratio, L *vs.* profile and slat angles for different values of slat width spacing ratio, W/S; slat thickness spacing ratio $= 0$

APPENDIX A

Equations for Absorptance and Transmittance

Specular Reflecting Slat Surfaces

Three cases are considered. In *Case I* none of the incident radiation is reflected away from the slats. In *Case II* part of the radiation is reflected away from the slats while in *Case III* no radiation can pass through the slats by reflections, though with certain slat geometry some incident radiation can pass directly through the slat opening. *Cases I* and *III* apply to positive values of ϕ. *Case I* with limits as noted in following text also covers all negative values of ϕ. Diagram 1a of Fig. 1 illustrates *Case II*.

The equations which follow apply to slat assemblies in which the thickness-spacing ratio, D/S, is negligible. A method of correcting the equations where D/S cannot be ignored is presented in this section. The number of parts into which a beam divides and the number of reflections which each portion of the beam undergoes is related to the width of the slats, the perpendicular distance between the slat surfaces, and the angle at which the incident beam strikes the slat. The nomenclature used is that listed in the forepart of the paper.

Case I: ϕ is positive, less than 90 deg and $(\phi + 2\psi)$ is less than 90 deg; ϕ is negative such that $(-\phi)$ is less than 90 deg.

$$T_D = \pm [\sin(\phi + \psi)/\cos\phi]\,[X(1-\alpha)^{N-1} + (B - X - Y \pm \sin\psi)(1-\alpha)^N + Y(1-\alpha)^{N+1}] \quad \text{(A-1)}$$

$$A_D = 1 - T_D \quad \text{(A-2)}$$

where

N = a whole number according to the following schedule:

$(W/S)/B$	N
0-2	1
2-4	3
4-6	5 etc.

$B = \pm [\cos\psi/\tan(\phi + \psi)]$

$X = \pm [\sin\psi - [(W/S) - (NB)]]$

$Y = \pm [\sin\psi + [(W/S) - (NB)]]$

Note: When ϕ is positive or when ϕ is negative such that $-(\phi)$ is less than ψ, use + sign where $\pm$ is indicated.

When ϕ is negative such that $-(\phi)$ is greater than ψ, use − sign wherever $\pm$ is indicated and observe trigonometric sign conventions; also interchange X and Y in the first and third terms of Equation A-1.

Whether ϕ is negative or positive, let $X = 0$ when X is negative and let $Y = 0$ when Y is negative.

When the absolute value of $\phi = \psi$, $T_D = 1.0$

Case II: ϕ is positive, less than 90 deg, $(\phi + 2\psi)$ is greater than 90 deg, and $(\phi + \psi)$ is less than 90 deg.

$$T_D = \frac{\sin(\phi+\psi)}{\cos\phi}\left[X(1-\alpha)^{N-1} - Z(1-\alpha)^{N+1}\right] \quad \text{(A-3)}$$

$$A_D = 1 - T_D - \left[1 - \frac{2\cos\psi\cos(\phi+\psi)}{\cos\phi}\right](1-\alpha) \quad \text{(A-4)}$$

where

N = a whole number according to the following schedule:

$[(W/S) - \sin \psi]/B$	N
less than 1	1
1-3	3
3-5	5 etc.

and where

$B = \cos \psi / \tan (\phi + \psi)$

$X = \sin \psi - [(W/S) - (NB)]$

$Z = X - 2B$

Case III: ϕ is positive, less than 90 deg. and $(\phi + \psi)$ is greater than 90 deg.

$$T_D = 1 - (W/S)\,[\sin(\phi + \psi) + \cos \phi] \quad \text{.....(A-5)}$$

$$A_D = (1 - T_D)\,a \quad \text{.....(A-6)}$$

Note: When $1 - (W/S)\,[\sin(\phi + \psi) + \cos \phi]$ is negative, T_D = zero and $A_D = a$.

Corrections for Slat Thickness

A correction for the effect of slat thickness can be made as follows:

1. Multiply W/S by the correction factor $1/[1 - (D/S) \cos \psi]$
2. Use the corrected value of W/S in the formulas or charts to find T_D and A_D
3. The corrected absorptance, A_D', and transmittance, T_D', are

$$T_D' = T_D\,(1 - P)$$

$$A_D' = A_D + (1 - P)a$$

where

$P = 1 - [(D/S) \cos(\psi + \phi)/\cos \phi]$

APPENDIX B

Equations for Transmittance and Absorptance

Diffuse Reflecting Slat Surfaces

This section treats the case of slat surfaces which are perfectly diffusing reflectors. Such surfaces always reflect part of the incident radiation away from the slats. There are two cases to be considered. In *Case I* part of the incident direct solar radiation passes directly through the slats while in *Case II* none passes directly through the slats. Diagram 1b of Fig. 1 illustrates *Case II*.

In *Case I* the formula for transmittance consists of three terms of which the first is the opening ratio, *L*. The second term involves a configuration factor F_1 which accounts for the fraction of the incident radiation falling on surface 1 and reflected from that surface through the opening between the slats. Since in *Case I* the irradiated length of the slat *m* equals the *slat width W*, F_1 is dependent only upon the geometry of the slat assembly. The third term involves several configuration factors to account for the infinite series of reflections between the slat surfaces.

In *Case II*, the opening ratio *L* is zero. In the first term of the equation for transmittance, F_4 accounts for the fraction of the radiation incident upon surface 1 which is reflected through the slat opening. However, the fraction of the slat width which is irradiated, m/W, depends upon the profile angle as well as upon the slat geometry. Hence F_4, unlike F_1, depends upon both slat geometry and profile angle. The second term is similar to the third term of *Case I* except that F_3 differs from F_2 in that it is a function of ϕ as well as the slat geometry.

The formulas B-1 to B-6 which follow have been derived rationally and involve no approximations. However, in evaluating the third term of Equation B-1 and the second of B-4, the configuration factors in these terms must, to be exact, take into account the fact that the radiation which is reflected from one surface is not uniformly distributed over the opposite surface. This was taken into account in preparing Figs. 8, 9 and 10, although some approximations were made to lessen the extensive numerical work required.

Although the formulas apply strictly to flat slats of infinite length, investigation has shown that they have good precision if the slats are no shorter than 20 in. and the curvature is no greater than $\frac{1}{4}$ in. in a width of 2 in. The effect of departure from a perfectly diffusing reflecting surface has not been estimated but is probably small. The formulas are for positive values of ϕ but can be adapted for negative values of ϕ. Corrections for slat thickness ratio are made as outlined in Appendix A.

Case I

$(W/S)\,(\sin(\phi + \psi)/\cos \phi)$ is less than 1.0.

$$T_D = 1 - \left[\frac{W \sin(\phi + \psi)}{S \cos \phi}\right]\left[1 - F_1(1-\alpha) - \frac{F_2(1-\alpha)^2}{1 - F_2(1-\alpha)}\left[F_3 + F_1 F_4 (1-\alpha)\right]\right] \quad \text{(B-1)}$$

$$A_D = \frac{\alpha W \sin(\phi + \psi)}{S \cos \phi}\left[1 + \frac{F_4(1-\alpha)}{1 - F_2(1-\alpha)}\right] \quad \text{.....(B-2)}$$

$$R_D = 1 - T_D - A_D \quad \text{.....(B-3)}$$

Case II

$(W/S)\,(\sin(\phi + \psi)/\cos \phi)$ is greater than 1.0.

$$T_D = (1-\alpha)F_4 + \frac{F_3(1-\alpha)^2}{1 - F_2^2(1-\alpha)^2}\left[F_3 + F_1 F_4 (1-\alpha)\right] \quad \text{.....(B-4)}$$

$$A_D = \alpha\left[1 + \frac{F_2(1-\alpha)}{1 - F_2(1-\alpha)}\right] \quad \text{.....(B-5)}$$

$$R_D = 1 - T_D - A_D \quad \text{.....(B-6)}$$

where

F_1 = fraction of radiation which leaves surface 1 (see diagram 1b of Fig. 1) and passes through the opening between the slats when $m/W = 1.0$

F_2 = fraction of radiation which leaves surface 1 and is intercepted by surface 2, when $m/W = 1.0$

F_3 = fraction of radiation which leaves surface 2 and passes through the opening between the slats when $m/W = 1.0$

F_4 = fraction of radiation which leaves surface 1 and passes through the opening between the slats when $m/W < 1.0$

F_5 = fraction of radiation which leaves surface 1 and is intercepted by surface 2, when $m/W < 1.0$

APPENDIX C

Absorptance and Transmittance of a Combination of Flat Glass and a Slat Assembly

Corrections for Reflections Between Glass and Slat Assembly

Flat Glass Between the Sun and the Slats: In this arrangement the incident beam passes through the glass with a reduction in intensity because of reflection and absorption by the glass. Part of this depleted beam is transmitted by the slat assembly and part is reflected back toward the glass. Of this latter part, a portion is absorbed or transmitted by the glass and the remainder is reflected back to the slat assembly. An infinite series of such reflections takes place. The first pair of such reflections, from slats to glass and back to the slats, is usually the only pair of significance. This pair is treated in the following equations which are simplified versions of the exact equations. A more exact treatment for practical use is not justified. It will be noted that the equations are written so that the term in parentheses is a correction factor which can be used with the rules previously given. For direct radiation the equations are

$$T_{gs} = \tau_D\, T_D\, (1 + R_D \rho_4) \quad \text{.....(C-1)}$$

$$A_g = \alpha_D\, (1 + \tau_D R_D) \quad \text{.....(C-2)}$$

$$A_s = \tau_D\, A_D\, (1 + R_D \rho_4) \quad \text{.....(C-3)}$$

where

T_{gs} = transmittance of the slat-glass combination

A_g = absorption of the glass in the combination

A_s = absorptance of the slat assembly in the combination

The upper case subscripts denote that the property so labeled applies to direct radiation, whereas the lower case subscripts refer to diffuse solar radiation. If the incident radiation is diffuse the same formulas apply except that all of the subscripts become lower case.

Slat Assembly Between the Sun and Flat Glass

$$T_{sg} = T_D\, \tau_4\, (1 + \rho_4 R_4) \quad \text{.....(C-4)}$$

$$A_g = \alpha_4\, T_D\, (1 + \rho_4 R_4) \quad \text{.....(C-5)}$$

$$A_s = A_D\, (1 + \rho_4 T_D) \quad \text{.....(C-6)}$$

The same equations apply to diffuse radiation by making all of the subscripts lower case.

Values of ρ_4 may be obtained from Reference 3 or the following values may be used: single ordinary window or plate glass 0.15; double ordinary window glass 0.20, single heat absorbing glass 0.10.

Garden and North Wing of The Essex & Sussex, Spring Lake, N.J.

June Meeting-by-the-Sea Attracts Members

ACCORDING to Committee on Arrangements General Chairman F. H. Faust, advance reservation requests point to a record attendance at the Semi-Annual Meeting 1952 in Spring Lake, N.J. The complete program lists 10 technical papers, and the entertainment features of the program will give every man, woman, and child three exciting days.

On Monday there will be a welcome luncheon, with G. F. Smith, president, Johnson & Johnson, Inc., speaking on The New Jersey Turnpike. The ladies will enjoy a boat trip through New York Harbor; affording a view of the world's greatest seaport, and also the Statue of Liberty, Lower Manhattan's skyline, the Brooklyn Bridge, Governor's Island, and many other points of interest along the Jersey shore.

Golf Tourney

Among the entertainment highlights will be the annual Golf Tournament with the Research Cup for the individual low net score and the Eichberg Memorial Trophy for the Chapter whose representatives score the lowest three man combined total. And last, and biggest of all, the Paul Bunyan Cup awarded to the holder of the highest 18 hole gross total.

For the ladies there will be a card party and entertainment on Monday afternoon and Monday night will feature a Surprise Party for all members and guests, with entertainment, dancing, fun and surprises for all.

Tuesday morning will be devoted to an entertainment program for the ladies and children while the highlight of the afternoon will be the Clambake and Beach Party. This affair will offer a real treat and a chance to savor the deliciousness and flavor of an old fashioned clambake prepared by an expert bakemaster. It will feature steamed clams, fish, lobster, sweet corn, watermelon, and all the trimmings. Music, dancing and just plain relaxation on the spacious veranda are planned for Tuesday night.

Sightseeing & Sports

Wednesday morning the ladies and children will be entertained by a sightseeing trip along the shore line to Asbury Park, Atlantic Highlands, and Sandy Hook. A complete program of sports is available for Wednesday afternoon, and for those who wish to go, there will be an inspection trip to the Lakehurst Naval Air Station, where the Navy's lighter-than-air craft and many of its helicopters are housed.

Banquet

As a fitting climax to three days of education and pleasure the Semi-Annual Banquet will be held on Wednesday night. The speaker will be W. G. McKinley, and J. C. Fitts will serve as toastmaster.

Those and the other scheduled events, plus the superb facilities of The Essex and Sussex Hotel for tennis, swimming, fishing, shuffleboard, and just plain rest, combine to attract an excellent attendance.

The New Jersey members of the New York Chapter, who are handling arrangements for the meeting, are looking forward to welcoming all members to Spring Lake on June 16, 17, and 18.

Have you made your reservations? Have you selected your route? Are you all set for Spring Lake?

THE ESSEX & SUSSEX

F. H. Faust
General Chairman

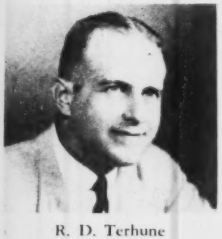
H. P. Morehouse
Vice Chairman

SPRING LAKE N.J.

SEMI-ANNUAL MEETING HOSTS

W. M. Heebner

W. A. Swain



R. D. Terhune

Committee on Arrangements

F. H. Faust, *General Chairman*

H. P. Morehouse, *Vice Chairman*

Banquet — W. A. Swain, *Chairman:* A. A. Driggs, Jr., G. C. Norman, L. H. Rooney.

Entertainment — R. D. Terhune, *Chairman:* R. L. Dobrin, Milton Simkin, F. E. Wendel.

Finance — W. M. Heebner, *Chairman:* S. H. Nitzberg.

Ladies — T. R. Peyrek, *Chairman:* Mr. & Mrs. H. A. Brangs, Mr. & Mrs. C. M. Loeser, Mr. & Mrs. J. F. O'Brien, Mr. & Mrs. H. M. Patrick, Mrs. T. R. Peyrek, Mr. & Mrs. F. J. Swaney, Mr. & Mrs. H. S. Wheller.

Publicity — P. B. Gordon, *Chairman:* W. G. Cox, L. M. Hedges, R. F. Thompson.

Reception — H. M. Rudio, *Chairman:* J. C. Fitts, *Vice Chairman:* William Caddle, F. H. Morgan, Jr., H. A. Thornburg, W. G. W. Turno.

Sessions — A. A. Bearman, *Chairman:* M. C. Christesen, J. H. Crawford, Jr., F. A. Fideli, Beatrice A. Hicks, B. F. Thomas, Jr.

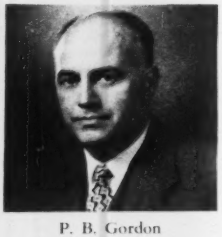
Sports — L. G. Huggins, *Chairman:* R. U. Berry, A. F. Hinrichsen, H. C. Hull, W. C. Kruse, Jr., J. N. McBride, H. J. Rose.

Transportation & Inspection — A. H. Moraweck, Jr., *Chairman:* R. W. Newell.

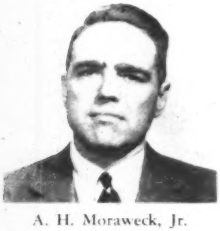
A. A. Bearman

T. R. Peyrek

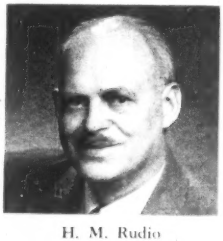
L. G. Huggins



P. B. Gordon



A. H. Moraweck, Jr.



H. M. Rudio

SEMI-ANNUAL MEETING PROGRAM

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

The Essex and Sussex, Spring Lake, N. J.
June 16-18, 1952

(Eastern Daylight Saving Time)

Saturday — June 14

12 noon Finance Committee Meeting, J. W. James, Chairman
4:00 p.m. Executive Committee Meeting, Dean L. E. Seeley, Chairman

Sunday — June 15

10:00 a.m. REGISTRATION — Reception of Members
10:00 a.m. Council Meeting
2:30 p.m. Committee on Research Meeting, I. W. Cotton, Chairman
2:30 p.m. Swimming and Beach Sports
3:30 p.m. Informal Get-Together — Musicale and Tea
9:00 p.m. Music — Movies: "Belles on Their Toes," Courtesy of 20th Century Fox

Monday — June 16

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION — *Ballroom*
- Experimental Data on Drying Atmospheric Air for a Supersonic Wind Tunnel, by W. E. Emley, Jr.
- A Low-Inertia Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum, and G. V. Parmelee
- Effectiveness and Temperature Requirements for Cooling Panels Removing Internal Radiation, by Merl Baker

11:00 a.m. Ladies Boat Trip
12:15 p.m. Welcome Luncheon
- *Speaker*: George F. Smith, president, Johnson & Johnson, Inc., New Brunswick, N.J.
- *Subject*: The New Jersey Turnpike

1:30 p.m. TAC on Odors, T. H. Urdahl, Chairman
1:30 p.m. Golf Tournament — Research Cup and Eichberg Memorial Trophy — Paul Bunyan Cup — Spring Lake Golf and Country Club
1:30 p.m. Deep-Sea Fishing Trips (Advance Registration Required)
2:00 p.m. Guide Committee Meeting, B. H. Jennings, Chairman
2:00 p.m. Ladies Card Party — Romance of the Music Boxes, by The Browns of Chatham
9:00 p.m. Surprise Party, Entertainment and Dancing

Tuesday — June 17

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION — *Ballroom*
- Moisture Migration in a Guarded Hot Plate, by N. B. Hutcheon and J. A. Paxton
- Cooling Load from Sunlit Glass, by C. O. Mackey and N. R. Gay

Tuesday — June 17 (*continued*)

- A Study of Transient Heat Method for Measuring Thermal Conductivity, by D. D'Eustachio and R. E. Schreiner

10:00 a.m. Ladies Program (and Children) "Magical Moments," by The Battons of Fort Monmouth
12:30 p.m. Clam Bake and Beach Party
2:30 p.m. Nominating Committee Meeting, M. W. Bishop, Chairman
2:30 p.m. TAC on Combustion, T. H. Smoot, Chairman
2:30 p.m. TAC on Heat Flow through Glass, R. A. Miller, Chairman
8:00 p.m. Chapters Conference Committee Meeting, A. J. Hess, Chairman
9:30 p.m. Music and Dancing

Wednesday — June 18

9:00 a.m. REGISTRATION
9:30 a.m. TECHNICAL SESSION — Research — *Ballroom*
- Report on Research — I. W. Cotton, Chairman, Committee on Research
- Outlet Turbulence Intensity as a Factor in Isothermal-Jet Flow, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza
- Exploration of a Chilled Jet, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza
- The Shading of Sunlit Glass — An Analysis of the Effect of Uniformly Spaced Flat Opaque Slats, by G. V. Parmelee and W. W. Aubele
- *A Smoke-Filament Technique for Experimental Research in Room Air Distribution, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza

10:00 a.m. Ladies Sightseeing Trip (Asbury Park — Atlantic Highlands — Sandy Hook)
2:00 p.m. Inspection Trip (Lakehurst Naval Air Station)
2:00 p.m. Informal Sports: Swimming, Shuffleboard, Horseback Riding, Fishing
6:00 p.m. Social Hour
7:00 p.m. SEMI-ANNUAL BANQUET — *Dining Room*
- *Toastmaster*: Joseph C. Fitts
- *Speaker*: W. G. McKinley

*To be presented by title.

Summary of Chapter Meetings*

ARKANSAS CHAPTER CHARTERED

Bruce Evans, St. Louis, presents Arkansas Chapter Charter to Pres. E. N. Pettit, Jr., with Herman Cumnock, vice president, and R. E. Blaylock, secretary-treasurer

Some 55 Arkansas heating and ventilating engineers were welcomed as a group to be known as the Arkansas Chapter of ASHVE, at a meeting held at the Albert Pike Hotel, Little Rock, Ark., April 15, 1952.

The Charter, which was presented by B. L. Evans, St. Louis, a member of the Society's Council and a past president of the St. Louis Chapter, was accepted by E. N. Pettit, Jr., president of the newly organized Arkansas Chapter. Mr. Evans also presented the Minute Book and the Kardex, which will contain the Chapter's records, to R. E. Blaylock, the secretary-treasurer of the Chapter.

The temporary officers elected at one of the earlier meetings, when plans were being formulated, were continued in office for the coming year. The following officers were elected: *President* — E. N. Pettit, Jr.; *Vice President* — Herman Cumnock; *Secretary-Treasurer* — R. E. Blaylock. The following committees were appointed by President Pettit to serve for the coming year: *Dues*: J. E. Mullins, *Chairman*; J. V. Evins, J. L. Coplin, Jr., J. L. Brown. *By-Laws*: H. M. Keller, *Chairman*; A. G. Crothers, J. W. Thompson. *Attendance*: C. H. Miller, *Chairman*; J. E. Mullins, H. H. Himstedt. *Entertainment*: J. C. Lewis, Jr., *Chairman*; K. A. Pettit, Morris Benkovitz.

Mr. Evans, following the presentation of the Charter, gave some interesting details on the *Aims and Activities* of the ASHVE, describing the various Society committees and duties of each. He brought out many of the significant incidents in the history of the Society, stating that the first chapter was organized in Chicago in 1906, and that the first edition of THE GUIDE was published in 1922. In concluding his remarks he called attention to the fact that the Society had approximately 2200 members in 1930, and at present there are over 8500 members.

At the first preliminary meeting, November 19, 1951, of the Arkansas group, D. M. Allen, Kansas City, former member of the Society's Council, outlined the functions of a chapter and some of the Society's history.

Charter dinner meeting of Arkansas Chapter

SZEKELY ADDRESSES OREGON CONFERENCE

The annual meeting and banquet of the Oregon Chapter was held in the Memorial Union Building, Oregon State College, Corvallis, Ore., on April 11, with Society Pres. Ernest Szekely as honored guest.

During the comparatively brief business session the outgoing president, H. W. McKenzie, reviewed the year's activities and the accomplishments of the chapter committees.

Past Pres. B. W. Farnes handled the installation of the new officers who are: *President* — K. H. Hanson; *Vice President* — A. N. Hoss; *Secretary* — W. R. Norte; *Treasurer* — R. H. Brown; *Board of Governors* — J. E. Finkbeiner, E. E. Kelly, and H. W. McKenzie.

T. E. Taylor handled the duties of toastmaster in his inimitable style. President Szekely was introduced by J. D. Kroeker and gave awards to students Reuben Peterson, Eldon Merklin, and David Blair, for their papers.

E. W. Smith, president of the Portland Chamber of Commerce, gave the main address on *Never More Precious*. He reviewed the progress of democracy from its inception in the United States and painted a very sober but optimistic picture of the future, based on mutual understanding attainable through education and the unceasing effort to maintain and preserve the American way of life.

Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

The Chapter meeting and banquet climaxed the 7th Air Conditioning Conference held at Oregon State College, April 10-12. The attendance at the Conference totalled 184, and was conducted under the chairmanship of K. R. Murhard. The technical program was developed under the direction of T. H. McClung. The technical papers covered a variety of subjects and were presented by renowned experts in their field. President Szekely spoke on the subject *Pneumatic Conveying*. Among other subjects were automatic controls, oil burner installations, noise encountered in heating, ventilating, and air conditioning systems, refrigeration, electric heating, and a panel discussion on the ideal residential heating system.

WESTERN MICHIGAN HOLDS FIRST MEETING IN JACKSON

Western Michigan members at April 14 meeting in Jackson, Mich.

Engineers turned out almost 200 strong at the first meeting in Jackson of the Western Michigan Chapter, establishing the host city as one of the meeting cities for this mobile chapter. There were 182 engineers on hand for the dinner at the First Congregational Church in Jackson and a few more arrived in time for the meeting which followed.

Pres. W. C. DeRoo called the meeting to order by welcoming all the new members and guests and asked that the Jackson members be given a vote of thanks for a fine job in making arrangements for the meeting and having such a large turn out.

The group then stood in silent meditation in memory of H. J. Metzger, a past president of the Chapter, and N. B. Fenton, both of whom died recently.

O. D. Marshall, chairman, nominating committee, presented the slate of officers for the 1952-53 season.

Practical Heat Pump Application — Present and Future was the subject of A. B. Newton's talk. Mr. Newton, engineering vice president of Acme Industries, Inc., Jackson, has spoken to other chapters, but fellow chapter members found their first opportunity to hear this fine discussion of the heat pump.

Different application techniques of the heat pump were described with illustrations of specific installations. A discussion of the economic factors of the heat pump revealed that operating costs for some heat source and sink combinations are competitive with conventional fuels and that initial costs of equipment and installation compare favorably with conventional equipment for heating and cooling in year-round air conditioning systems.

A very active question and answer period followed Mr. Newton's talk.

Arrangements for this meeting were handled by N. A. Buckley and L. A. Tilford, assisted by K. L. Lamm, E. H. Ryden, W. C. Harrower, J. H. Kline, and D. W. Locklin, all of Jackson. Attendance 195. Attendance ratio 0.46.

• *ATLANTA*—March 10, 1952. Following the social hour and dinner, the meeting was called to order by Pres. F. A. Player in the Harris Tea Room. The minutes of the previous meeting were read and approved and T. A. Barrow, Jr., treasurer, submitted his report. A discussion was then held regarding the annual social meeting in May and it was voted that it would be a formal affair.

Chapter member, J. A. Marshall, regional sales manager, Commercial Division, Minneapolis-Honeywell Regulator Co., Atlanta, spoke on *Electronic Air Conditioning Controls*. Mr. Marshall also showed a film and slides covering the fundamentals of the vacuum tube and basic electronic control circuits. Attendance 35.

• *CENTRAL OHIO*—March 17, 1952. The meeting was a joint affair with the Cincinnati Section of *The American Society of Refrigerating Engineers* and the Miami Valley Chapter of ASHVE. It was held at Anticolli's Restaurant, Dayton.

The guest speaker was G. E. Graff, sales manager of Ranco, Inc., who spoke on *The History of Thermostats*.

• *CINCINNATI*—April 1, 1952. The meeting was called to order by Pres. J. J. Bechtol, and the guests, among whom were C. D. Weaver and D. E. Tullis of the Miami Valley Chapter, were then introduced. The minutes of the March meeting were read and approved. The treasurer submitted his report; and the following auditing committee was appointed: M. E. Mathewson, K. M. Reik, and Ludwin Jensen. An invitation was extended to the Miami Valley Chapter to attend the Chapter's May meeting and Messrs. Weaver and Tullis retaliated with an invitation from the Miami Valley Chapter to attend their Spring Dance on April 25. A discussion concerning the Chapter's eagerness to have the Society hold its 1954 Annual Meeting in Cincinnati was held, and Mr. Weaver offered the Miami Valley Chapter's assistance if Cincinnati is selected.

The meeting adjourned and the group then gathered in the auditorium to hear H. B. Nottage, research associate, ASHVE Research Laboratory, speak on *Research Techniques and Experiences in Room Air Distribution*. Attendance 46.

• *CONNECTICUT*—April 17, 1952. The meeting was called to order in the Three Cup Inn, Meriden, by Pres. A. J. Lawless. The treasurer's report was read and accepted, and T. L. Arnold introduced J. M. Augur and G. F. Altemueller, new Chapter members, and announced a total of 15 new members for the year.

The following officers were elected for the year 1952-53: *President*—T. L. Arnold; *Vice President*—G. F. Nieske; *Secretary*—C. L. L'Hommedieu; *Treasurer*—R. W. Sidbury; and *Board of Governors*—W. L. Johnson, E. J. Hoagland, and A. J. Lawless. Mr. Lawless, retiring president, expressed his appreciation for the cooperation he received during the year, and he then presented the gavel to President Arnold.

Harold Hilton of the *National Board of Fire Underwriters* spoke on *Fire Protection in the Installation of Heating and Ventilating Equipment*. Attendance 46.

• *CONNECTICUT*—March 11, 1952. Pres. A. J. Lawless called the meeting to order in the Algonquin Club, Bridgeport, at 8:30 p.m. An auditing committee was appointed, consisting of S. R. Osborne and C. F. Ganter; and Vice Pres. T. L. Arnold presented the membership committee report. President Lawless presented a past president's pin to D. M. Hummel, president for 1950. The nominating committee presented the slate of nominees for 1952 officers.

R. S. Dill, chief, Heating and Air Conditioning Section, *National Bureau of Standards*, Washington, D.C., spoke on *Research in Domestic Heating*. Attendance 76.

• *DELTA*—April 8, 1952. Pres. Theodore Offner called the meeting to order in the Trophy Room of the New Orleans Athletic Club. Members introduced themselves and their guests, and the minutes of the March meeting were read and approved. President Offner announced the nominees for officers for 1952-53, and stated that the Chapter's May meeting would be held on the new meeting date, the third Tuesday of each month. G. E. May spoke on the Vocational Guidance Program initiated by the *Louisiana Engineering Society*, whereby all high school students would be given a talk, outlining the benefits and advantages of the engineering profession.

A. J. Hess, member of the Society's Nominating Committee, and president, Hess-Greiner & Polland, Los Angeles, spoke on *Plant Research in the Phytotron*. Mr. Hess described a laboratory in which plants are grown in a synthetic and sterile medium, other than soil, and in which the air is conditioned and the circulation very carefully controlled. He emphasized the role of heating and air conditioning in the control of environmental conditions for the growth of vegetation. Attendance 28. Attendance ratio 0.28.

• *GOLDEN GATE*—March 6, 1952. Pres. T. J. Janes called the meeting to order at 8:10 p.m. in Cory Hall, the new engineering building, on the University of California campus. The roll call was taken at dinner, which was served in the Campus Cafeteria, preceding the business meeting. The minutes of the February meeting were read and approved with a slight correction.

President Janes then introduced Prof. N. W. Snyder, University of California, who spoke on the research and testing work in progress on package cooling towers. He described the features of vertical flow and crossflow types of cooling towers.

The next speaker was Professor Shade, who described the University's Institute of Engineering Research, which offers to industry comprehensive research facilities and technicians. He stated that services, valued at about $1\frac{1}{2}$ million dollars per year, are performed at cost for industry and the armed services.

Tours were then conducted through the acoustics, standards and illuminating laboratories, and the instruments used and the nature of the research being conducted in each laboratory were explained by the professor in charge. Attendance 51.

• *ILLINOIS*—April 14, 1952. Vice Pres. M. W. Bishop called the business meeting to order, following a social hour and dinner in the M. & M. Club. C. M. Vreuls introduced the out-of-town guests, and H. G. Gragg reported as chairman of the membership committee. Vice President Bishop announced that the survey taken on whether or not a new meeting place should be selected indicated that better than 60 percent of the membership preferred the M. & M. Club.

The guest speaker of the evening, C. B. Genther, Pace Associates, architects and engineers, Chicago, delivered an interesting address on the unusual design features of heating skyscraper apartment buildings. He spoke in detail on the problems encountered in the design of the heating system for the new all glass and steel apartment building at 2933 Sheridan Road in Chicago, which he described as follows:

Over 9 miles of copper tubing were used in the radiant panel heating system installed. Heat is supplied by two oil-fired, low-pressure hot water boilers and heat is transferred to the forced hot water heating system by a water-to-water converter. The converter absorbs the static head of the heating system so that the boilers may be operated at low pressure.

The apartment heating layout consists of a forced hot water up-feed system with an expansion tank located in the penthouse. Individual apartments are heated by radiant coils embedded in the 7 in. concrete slab. Coils are $\frac{3}{8}$ in. ID copper tubing, and the distance from the center line of the tubing to the bottom of the slab is $\frac{3}{4}$ in. The bottom of the slab serves as the ceiling of the apartment below, and the top of the slab, the floor of the apartment above. Flooring consists of 5/16 in. cork tile, laid directly on the slab. Typical coils serving rooms with one exterior glass wall are laid 18 in. on centers. Coils serving rooms with two exterior glass walls are placed 9 in. on centers.

When the outdoor temperature is 10 deg below zero and the outside wind velocity

is 15 mph, the temperature of the water supplied to the coils is 175 F. The water temperature drop in the coils was said to be 30 deg. The average water temperature for this design condition is 160 F and the calculated surface temperature of the concrete ceiling (for the 18 in. coil spacing) is 113.6 F. The calculated value of the average surface temperature of the cork floor, under design conditions, is 83.3 F. About 70 percent of the heat supplied to each apartment is from the ceiling, and about 30 percent from the floor.

Individual temperature control is provided for each apartment. The two bedroom units have one control valve for the living and dining areas and also one control valve serving only the bedrooms. In addition to individual apartment control, a three-way mixing valve in the boiler room modulates the system water temperature in accordance with outside weather conditions. The heating system circulating pumps run continuously during the heating season and are shut off automatically when the outside temperature rises above 65 F. Many of the exterior walls of the apartments consist largely of single glass.

In conclusion, Mr. Genther stated that results to date, from the standpoint of comfort, installation costs and operating costs have been satisfactory. He pointed out that most of the tenants have draw draperies which are used in the evening and which are often used during hours of sunlight, particularly on the west exposures. An interesting discussion, particularly on the comfort of the tenants, followed. Attendance 131. Attendance ratio 0.25.

• *ILLINOIS*—March 10, 1952. Pres. G. W. Bornquist opened the meeting and called for reports from the various committee chairmen. The meeting was then turned over to R. O. Nelson, chairman of the meeting, who introduced J. D. Pierce, chief engineer, Vulcan Radiator Co., Hartford, Conn., who spoke on the *Cost of Heating a Residence*. Mr. Pierce expressed his opinion that steam and hot water heating costs were no more than warm air. He gave specific examples of a residense that was heated successfully with baseboard radiation, series loop, baseboard radiation with two-series loop, one-pipe system, one-pipe system with 180 deg water, etc., and gave the cost of each system.

Before throwing the meeting open for discussion, A. W. Lippit announced the result of the election of the nominating committee as follows: M. J. Bamond, M. W. Bishop, G. W. Bornquist, H. G. Chapin, E. P. Heckel, Jr., P. J. Marschall, G. V. Zintel.

J. D. Pierce
Hartford, Conn.

After the question and answer period, the meeting adjourned at 9:00 p.m. Attendance 150. Attendance ratio 0.27.

• *INDIANA*—February 22, 1952. The meeting was called to order by Pres. F. C. Barton in the Warren Hotel, Indianapolis, and H. F. Johnson, Jr., and W. A. Sigman were introduced as new Chapter members.

The feature of the evening was a panel discussion on the subject, *Certified Welders*. R. G. James, program chairman, introduced the panel members as follows: W. W. Grear, chairman, J. T. Hardin, Alfred Meyer, all Chapter members, and G. Loving and R. Jennis. The panel discussed the procedure of certifying welders, which had been approved by the insurance companies, and also discussed how welders, as individuals, are qualified and approved under the procedures. It was brought out in the discussion that contractors have formed a chapter of the *National Pipe Welding Bureau*. Attendance 28.

• *INDIANA*—January 25, 1952. Pres. F. C. Barton called the meeting to order in the Warren Hotel, Indianapolis. The introduction of the guests followed, and the transacting of Chapter business was dispensed. Among the guests was Cyril Tasker, director of research, ASHVE Research Laboratory, Cleveland, Ohio, who was introduced by I. W. Cotton, chairman of the Committee on Research.

Mr. Cotton then introduced P. B. Gordon, vice president, Wolff and Munier, Inc., New York, N.Y., who gave an interesting talk on *Panel Heating*. Attendance 12.

• *INLAND EMPIRE*—March 20, 1952. Pres. L. E. Marque called the meeting to order and the minutes of the previous meeting were read and approved. President Marque presented the board of governor's report, and H. A. Bickel reported for the attendance committee. The following nominating committee was appointed: G. C. Murray, A. L. Niemoller, J. E. Hutsinpiller, J. A. Doyle, and P. R. Inman. It was announced that A. J. Hess, Los Angeles, Calif., member of the Society's Nominating Committee, would be a guest at the May 9 meeting and would help the newly elected officers arrange a program for the coming year.

The speaker of the evening was R. B. Plass, chief engineer, Ray Oil Burner Corp., San Francisco, Calif. Mr. Plass spoke on *Rotary Type Oil Burners and Their Installation*, and his talk was illustrated with slides. Attendance 23.

• *INLAND EMPIRE*—February 15, 1952. Vice Pres. P. J. Favre called the meeting to order, and the minutes of the previous meeting were read and approved. The treasurer's report was submitted by J. A. Doyle, and a discussion was held concerning a speaker for the next meeting.

There was no further new or old business, and a panel discussion was opened on *Radiant Heating*. Frank Jenkins of Funk, Mollander & Johnson, gave his experience with radiant heat with unit ventilator application as applied to the St. Charles school. Mr. Ponto of the Federal Housing Authority then discussed his experience with warm air radiant systems with high wall returns. The latter subject brought forth a discussion on evaporative coolers, and

other factors of general interest were discussed, including radiant heat with fin-tube application, trade practices, problem jobs and costs. Attendance 18.

• *IOWA*—April 8, 1952. The meeting was called to order in the Standard Club, Des Moines, by Pres. C. H. McGuiness. The minutes of the March meeting were read and approved. President McGuiness announced that he had appointed the following nominating committee: D. E. Wells, chairman, G. J. Kraai and D. C. Murphy. The committee submitted its nominations for 1952-53 officers, which were unanimously approved. It was announced that the proposed project of rewriting the Chapter's Constitution was still being studied.

Leonard Wolfe, professor of architecture and practicing architect, Ames, Ia., spoke on *Problems in Specification Writing and Interpretation*. Professor Wolfe told of the many difficulties involved in writing adequate and realistic specifications on building materials, mechanical equipment, and labor and construction techniques. He presented many provocative ideas which could very well lead to a more adequate solution of these problems. The talk was followed by a lively discussion period. Attendance 37.

• *KANSAS CITY*—April 7, 1952. Vice Pres. W. A. Reichow was the presiding officer at the meeting, which was called to order at 7:45 p.m. in the Wishbone Restaurant. Members and guests introduced themselves; and the minutes of the March 3 meeting were read and approved. Reports were made by A. S. Hurt, Jr., chairman of the attendance committee, and C. D. Jones, chairman of the public relations committee. W. E. Howarth, chairman of the nominating committee, presented the nominees for officers for 1952-53. An announcement concerning the Semi-Annual Meeting at Spring Lake, N.J., was then read.

J. R. Doxsee, Bert J. Clarke Co., introduced E. V. Sullivan, who spoke on *Night Air Cooling*. Mr. Sullivan's talk was illustrated with slides. Attendance 78. Attendance ratio 0.44.

• *MANITOBA*—March 20, 1952. The meeting was called to order by Pres. J. F. Bertram in the Fort Garry Hotel; and the minutes of the previous meeting were read and approved as read. H. F. Randall was put in charge of refreshments for the next meeting, and Gordon Christie was put in charge of hotel arrangements. It was announced that President Bertram was making reservations with the Pine Ridge Golf Club for the May season-ending party.

Dr. R. C. Jordan, professor and head, Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minn., spoke on *The History of Refrigeration and Heat Pumps*. He compared present-day methods of refrigeration and heating with those used 50 and 100 years ago. Then he went on to describe what can be expected in these fields in the future. A question and answer period followed the talk. Attendance 24.

• *MEMPHIS*—February 18, 1952. Following dinner in the King Cotton Hotel, Pres. R. E. Larkin called the business meeting to order and introduced and welcomed the guests. The minutes of the previous meeting were read and approved as corrected. C. S. Fischer, member of the Society's Chapters Conference Committee, presented a report on that Committee's meeting in St. Louis. He announced that slides on the research program would be available with or without speakers and also that the overall membership gain for last year was 10 percent.

The meeting was then turned over to P. M. Yates, who presented a colored sound film on the manufacture of seamless steel tubing. Attendance 21.

• *MIAMI VALLEY*—March 5, 1952. Members met for dinner at 7:00 p.m. at Neil's Restaurant; and Pres. C. D. Weaver, Jr., called the meeting to order. The minutes of the February meeting were read and approved; and the reports of the president and vice president were given. D. E. Tullis, chairman of the dance committee, announced that final arrangements had been made to hold a Barn Dance at The Willows on April 25. R. A. Frey announced that the April 17 meeting would be a joint meeting with the *American Society of Refrigerating Engineers* at Anticoli's. President Weaver appointed the following nominating committee: G. L. Leupold, J. M. Schweiger and R. C. Allen.

Charles Cave, Airtemp Division, Chrysler Corp., Dayton, Ohio, spoke on *Capacity Control on Refrigerating Compressors*. Mr. Cave began his talk by stating that capacity control is needed in air conditioning systems because the maximum design conditions occur so infrequently that the compressor is operating under a reduced load most of the time. He enumerated the various types of capacity controls as follows: cycle compressor; modulating expansion valve; balanced loader system; and temperature actuated back pressure valve.

Mr. Cave described a special capacity control system in which a hydraulically operated cylinder unloads by opening the discharge valves on each cylinder of the compressor to reduce the pumping capacity as required to meet the load. This type unloader can be controlled by either a thermostat operating the mechanism on a rise or fall of temperature or by a manual spring adjustment to maintain constant suction pressure. Attendance 24.

• *MONTREAL*—March 17, 1952. The meeting was called to order by Pres. J. G. Chenevert in the Berkeley Hotel, following dinner. The minutes of the February meeting were read and approved as read.

Robert Clapperton introduced the speaker of the evening, Brig. Gen. J. G. Gauvreau, who spoke on *Civil Defense Organization*. General Gauvreau outlined and described the proposed civil defense program for

Montreal. He explained how a well-organized program can make the greatest use of existing services, such as the fire, police, public works and public health departments. He also emphasized the need for expanded hospital facilities and decentralized services in the event of any enemy attack. During the question and answer period which followed, it was pointed out that an attack on Montreal could affect 10 percent or more of the country's total population, therefore making the city a number one target.

• *NEBRASKA*—April 8, 1952. Following the social hour and dinner, Pres. K. E. Martin called the meeting to order at 7:00 p.m. in the Castle Hotel. Self-introduction of everyone present was called for, and President Martin introduced two new Chapter members, H. J. Martig and C. W. Amidon, and he also announced that J. M. Thompson had been advanced to junior grade. H. H. Ulrich announced that the Twenty-First Annual Round-up of the *Nebraska Engineering Society* would be held on Saturday, April 26, in Omaha.

C. W. Little, sales manager, Fedders-Quigan Corp., Buffalo, N.Y., gave an interesting talk on *A Rational Approach to Heating Surface Design*. As a sidelight, Mr. Little also spoke briefly on the cooling of automatic transmissions. Attendance 26.

• *NEW YORK*—April 21, 1952. The Annual Meeting of the Chapter was called to order by Pres. Ernst Graber at 7:30 p.m. in the Building Trades Club, New York City. The business meeting followed a social hour and dinner. The minutes of the March 17 meeting were read and approved, and membership chairman, C. S. Koehler, presented the names of the following new members: H. A. Cohan, Jr., Lawrence Cartolano, W. B. Foxhall, C. P. Roberts, and Irving Weingrod. The report of the auditing committee and the reports of the treasurer and secretary were presented and placed on file. The following officers were elected for the year 1952-53: *President*—P. B. Gordon; *Vice President*—J. E. Schechter; *Secretary*—C. H. Flink; *Treasurer*—W. M. Heebner; and *Board of Governors*—H. S. Birkett, Ernst Graber, J. B. Hewett, R. L. Stinard, and Clifford Strock.

Mr. Gordon called attention to the good financial condition of the New York Chapter and stated that the Board of Governors recommended that a contribution of $1000 be made to the general research fund of the Society. It was unanimously voted that a check in that amount be presented to the Society at the Semi-Annual Meeting in Spring Lake.

J. B. Fullman, technical representative, A. M. Byers Co., New York, N.Y., spoke on the subject *Predicting Corrosion in Heating, Ventilating and Air Conditioning Systems from Corrosion Test Results*. Mr. Fullman gave a brief discussion on theories of corrosion and referred to corrosion testing methods in which small samples were exposed to various atmospheric and moisture conditions. He showed by means of slides the results obtained with various metals tested for a number of years.

He stated that in some cases it was found that two metals which differed greatly in corrosion resistance at the end of one year could be very much alike at the end of a longer period, and then might again differ as the length of time became longer. This illustrated the importance of tests having a long duration. Certain test results were shown which indicated that the size of test specimen might have an effect upon the amount of corrosion shown. Various examples of electrolytic corrosion were discussed and slides were shown indicating the changes in current flow which varied with the length of time and with changes which occurred in the metals due to corrosion.

Mr. Fullman's discussion made it evident that general conclusions should not be drawn from tests of small specimens for application to installations unless it was ascertained that the conditions surrounding the installation would be similar to those under which the corrosion tests had been conducted.

At the conclusion of the question and answer period, a rising vote of thanks was extended to Mr. Fullman. Attendance 60. Attendance ratio 0.11.

• NORTH TEXAS—April 21, 1952. Pres. R. E. Allison called the meeting to order at 8:15 p.m. in the Melrose Hotel, and members introduced themselves and their guests. The minutes of the March meeting were read and approved.

Dr. Amos Turk, director of research and development, W. B. Connor Engineering Corp., Danbury, Conn., spoke on *Odors, Their Nature, Causes and Control*. The first part of Dr. Turk's talk covered odor perception, classification and measurement. From there, he went on to describe the three basic odor control techniques; namely, adaptation, combustion, and absorption. According to Dr. Turk, the best absorption medium now available is activated carbon, due to its great surface area and its property of no moisture affinity. The talk was accompanied with slides, which illustrated past and present techniques used in the adaptation of activated carbon cells to ventilation systems. Attendance 81. Attendance ratio 0.40.

• NORTH TEXAS—March 17, 1952. Pres. R. E. Allison called the meeting to order at 8:15 p.m. in the Cattleman's Cafe, following an excellent dinner. Members introduced their guests, most of whom came from Fort Worth and Dallas.

R. A. Grimmer introduced the speaker of the evening, F. S. Gist, Fort Worth, who delivered a brief but excellent address, entitled *Your Monuments to Life*.

The minutes of the February meeting were then read and approved, and a report was made by the program committee. Attendance 100. Attendance ratio 0.46.

•*NORTH TEXAS*—February 18, 1952. In the absence of the president, M. W. Brown, secretary, called the meeting to order, and R. G. Lyford served as acting secretary. Members introduced themselves and their

guests, and the minutes of the January meeting were read and approved.

Dr. R. C. Jordan, professor and head, Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minn., spoke on *The Heat Sources and the Heat Pump*. Briefly, Dr. Jordan stated that the heat pump has been employed in about 2000 installations, and he added that it can look forward to a promising future along with or in conjunction with solar heating. Whether or not it is technically feasible is no longer a problem as its use is merely a question of the economics involved in each case. Dr. Jordan supplemented his address with slides, and an interesting question and answer period followed the address. Attendance 92. Attendance ratio 0.49.

• *NORTHERN OHIO*—February 11, 1952. Pres. John Richmond called the meeting to order in the Warner Auditorium of the Cleveland Engineering Societies Building. The minutes of the previous meeting were read and approved, and C. M. Humphreys, program chairman, announced that the speaker for the next meeting would be L. S. Cochran of Lockport Cotton Batting Co., Lockport, N.Y. Vice Pres. R. E. Sherman reported on the Annual Meeting in St. Louis, and President Richmond announced that the Chapter had been invited to participate in the activities of Engineering Week, which had been designated by President Truman and Governor Lausche.

J. F. Collins, Jr., secretary-treasurer, the *National District Heating Association*, Pittsburgh, Pa., spoke on *District Heating*. Mr. Collins introduced some of the local *NDHA* members who were in attendance at the meeting, and then he began tracing the development and growth of district heating. He pointed out its advantages to the owner as well as the community. Mr. Collins also presented slides which showed typical underground pipe installations and the underground distribution of district steam for a number of cities. A question and answer period followed, and some of the points brought out were that: (1) air conditioning application of steam in sorption systems is a matter of individual consideration in every case; (2) few district heating systems are presently using condensate return to plants; (3) metering is done by flow measurement in the newer systems and by condensate in the older; and (4) efficiency is in the order of 75 to 80 percent in the generating plant. Attendance 60. Attendance ratio 0.28.

• *OKLAHOMA*—April 14, 1952. The meeting was called to order in Beverly's Drive-In by Pres. J. H. Carnahan, who announced that the British Columbia Chapter had been established at Vancouver, B.C., Canada, and the Arkansas Chapter had been established at Little Rock, Ark. It was also announced that two new Society members had joined the Chapter, Everett Blanchard and W. R. Johnson.

Lewis Smith, C. A. Dunham Co., New York, N.Y., spoke on *Steam Heating*, including an explanation of the fundamentals of heat control in buildings and a description of the various methods used. Mr. Smith also discussed the merits of the various types of heating systems along with each one's individual control system, including such factors as the hours of heating, maximum demand, and zoning for exposure and occupancy. The effect of orificing of radiators and convectors and the use of vacuum and condensate pumps were also explained.

Mr. Smith also discussed briefly a special piping system used in insurance company housing projects in New York City. He explained the need for exposure factors and indicated that zoning is necessary but added that the multiple zoning occasionally encountered is not always entirely justified. Attendance 51. Attendance ratio 0.13.

• *OKLAHOMA*—March 10, 1952. The feature of the evening was a highly interesting and illustrated lecture on *Severe Weather — Thunderstorm Type* presented by Lt. Col. E. J. Fawbush and Major R. G. Miller, of the Severe Weather Warning Center, Tinker Airforce Base, Oklahoma City, Okla. It was explained that the tornado is a parasite of parent thunderstorms and is typically American, since 85 percent of all known tornadoes have occurred in North America. They stated that tornadoes are due to the weather elements of wind and moisture, and that the area between the Rocky Mountains and the Appalachian Mountains is ideal for their development. They traced their seasonal and geographic progress from the Gulf Coastal States northwest to Oklahoma and then northeast to Iowa, and they added that when warm moist air and cold dry air meet in these areas the possibility of thunderstorms leading to tornadoes is quite probable.

It was stated that the known limits of tornadoes range up to 1⅛ miles maximum width and up to 225 miles in length with speeds from the usual 30 mph up to 129 mph. They added that there is complete destruction where the spout touches the earth, but since this does not always occur in occupied areas a great majority of tornadoes are not heard of. Tornado damage is due to three things: (1) horizontal winds which may range up to 100 mph; (2) the upward spiraling winds which may range up to 300 miles per hour; and (3) the exploding effect due to change in pressure. In conclusion, it was stated that May is usually the worst month with regard to tornadoes, locally. Attendance 51. Attendance ratio 0.14.

• *ONTARIO*—April 8, 1952. Pres. William Philip called the meeting to order in the Royal York Hotel. He presented a Life Membership Certificate to W. R. Blackhall, and J. H. Fox presented M. W. Shears with his Life Membership Certificate. President Philip then announced the death of Ontario Chapter member, R. F. Wormley. L. R. Nash of the University of Toronto was presented with the Chapter's yearly award for the best thesis on heating, ventilating, or air conditioning, written by

an engineering student at the University. J. A. Slemin, president of the University of Toronto Student Branch, was the runner-up and he was presented with a copy of THE GUIDE.

H. A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., spoke on *Hot Water Heating*. An interesting and educational discussion period followed. Attendance 103.

• *PHILADELPHIA*—April 10, 1952. Pres. E. K. Wagner called the meeting to order in the Engineers Club at 8:10 p.m. The minutes of the March meeting and the treasurer's report were read and approved. The following officers were elected to serve for the year 1952-53: *President*—M. E. Barnard; *First Vice President*—C. F. Dietz; *Second Vice President*—L. M. Church; *Secretary*—C. J. Lubking; *Treasurer*—A. M. Robertson; and *Board of Governors*—P. H. Yeomans. President Wagner announced the dates of the Semi-Annual Meeting at Spring Lake, N. J., as June 16-18.

A. W. Courtney, in charge of design of component parts for air conditioning equipment, B. F. Sturtevant Division, Westinghouse Corp., Hyde Park, Mass., spoke on *Large Hermetic Compressors*. Mr. Courtney's address, which traced the development of hermetic compressors, was accompanied with slides. A question and answer period followed the talk. Attendance 45.

• *PITTSBURGH*—April 21, 1952. Members and guests met for dinner in Webster Hall, and the business meeting was called to order by Pres. W. D. Simpson. Past presidents of the Chapter in attendance at the meeting were introduced, and the minutes of the March 17 meeting were read and approved. President Simpson announced the formation of the Arkansas and British Columbia Chapters, and he also announced that the Massachusetts Chapter was celebrating its 40th anniversary. The secretary was instructed to send a letter of congratulations to the Chapter. This was followed by the reading of the nominating committee's report by the secretary.

B. B. Reilly introduced the speaker of the evening, C. M. Humphreys, senior engineer, ASHVE Research Laboratory, Cleveland, Ohio. Mr. Humphreys spoke on *The ASHVE Research Program*, discussing the aspects of the current studies on air distribution and drafts, solar heat gain through glass, shading dimmers, odors, and newer air cleaning methods. The talk was illustrated with slides and was followed by a discussion period. Attendance 37.

• *ST. LOUIS*—April 8, 1952. Pres. L. L. Hamig called the meeting to order at 7:30 p.m. in Town Hall. Self-introduction of members and guests followed, and the minutes of the February meeting and the treasurer's report were read and approved. J. B. Killebrew, membership chairman, announced that an application for membership in the Society had been received from S. M. Kennard. C. H. Burnap announced that the next meeting would be held on May 13 and would feature the election and installation of new officers and the showing of a film on *Exhaust Ventilation*. The report of the nominating committee was then presented and announcements concerning the success of the Annual Meeting were made. President Hamig announced that B. L. Evans had been elected a member of the Council, and I. W. Cooper read a letter from the St. Louis Browns' Boosters Club inviting the Chapter members to participate in the opening day of the Browns 1952 Season on April 18. President Hamig also announced that letters of congratulation were being sent to the newly formed Arkansas and British Columbia Chapters.

H. J. Kipp, Curtis Engineering Co., St. Louis, spoke on *News and Views on Refrigerant Compressors*. The talk was illustrated with slides and a question and answer period followed. Attendance 52.

• *SHREVEPORT*—April 17, 1952. The meeting was called to order in the Colonial Room of the Caddo Hotel by Secretary M. A. Hudson in the absence of both the president and vice president. The minutes of the March meeting were read and approved. Secretary Hudson announced that letters of welcome had been sent to the Arkansas and British Columbia Chapters, and S. W. Beatty made a brief report on the Charter meeting of the Arkansas Chapter on April 15.

Reg F. Taylor, first vice president of the Society, and consulting engineer, Houston, Tex., spoke on *Systems for Cooling*. He divided the field into three ranges: small size — 3 to 25 tons, medium size — 25 to 75 tons, large size — 75 tons and up. He pointed out that window units were about the only systems available for low cost housing although the operating expense of one of these units was equal to or more than the cost of heating the entire house. Pointing out that self-contained, packaged units were almost universally used on the small size jobs, Mr. Taylor made a number of suggestions on things to be cautious of — primarily, loading up the fan when the coil becomes choked with moisture. In the medium size field, it was pointed out that a combination of packaged units fits into certain applications while field assembled systems were used in the majority of cases and in all large size applications.

Using diagrams, Mr. Taylor presented a number of methods of conditioning the air and distributing it to the space. Mr. Taylor discussed radiant cooling, emphasizing the necessity of keeping the panels at a temperature above the dewpoint and controlling the humidity with ventilating air. Mr. Taylor stated that present thinking is that the ventilating air will amount to about 50 percent of the air requirements of a conventional system. Attendance 32. Attendance ratio 0.50.

• *SOUTH TEXAS*—March 21, 1952. Following a social hour and dinner, the meeting was called to order by Vice Pres. C. L. Fleming. J. R. Jones, sales engineer, York Corp., and E. B. Appling, engineer with Reg F. Taylor, consulting engineer,

gave brief biographical sketches. J. C. Lewis gave a brief report on the progress of the symposium to be conducted by the Engineers Council; and D. M. Mills commented briefly on the forthcoming conference on *Tropical Housing and Buildings* to be held at the University of Texas, Austin. B. P. Fisher announced that the next meeting would feature a panel discussion on *Opportunities for Air Conditioning in Hospitals.*

Vice President Fleming introduced E. R. Michel, Worthington Corp., who traced the history and development of refrigeration. Attendance 56. Attendance ratio 0.34.

• *SOUTHWEST TEXAS*—March 20, 1952. The meeting was called to order in the Bright Shawl, San Antonio, and the reading of the minutes of the previous meeting was dispensed with due to the lack of time. An announcement was made concerning the prompt payment of dues in order to facilitate completion of the Chapter directory. An invitation to the Semi-Annual Meeting, Spring Lake, N. J., June 16-18, was read, along with an invitation to attend the conference on *Tropical Housing Research* at the University of Texas on April 8 and 9, which would be followed by a meeting of the ASHVE short course committee. D. M. Mills, a guest from the South Texas Chapter, was introduced and he urged all who could to attend the meeting in Austin.

James Lane, of the Defense Research Laboratory, University of Texas, Austin, presented a talk on *Noise and Sound as Applied to Air Conditioning.* Mr. Lane explained and defined the decibel, pointing out that one decibel is the minimum detectible change in sound level. He discussed the relationship of intensity and frequency as affecting loudness, and he explained total loudness, measured in sones, and loudness level, measured in phons. Mr. Lane told of the various means used in sound control, that is, its source, and by restricting vibration transmission through walls. Applying the theory of sound to the air conditioning field, he stated that transmission through porous walls is quite good and that sound absorbing materials alone transmit sound well. He then went on to discuss lining ducts, canvas connections, and the use of honey combs, sound traps and sound filters. Attendance 42.

• *WESTERN NEW YORK*—April 14, 1952. Following dinner in the University Club, Pres. T. F. Killeen called the meeting to order and the minutes of the March meeting were read and approved as read. A report on the Technical Societies' Conference on April 29 was given, and Van Ness Harwood suggested that Chapter members mention the conference to any engineering organizations that might be visiting. President Killeen announced that Joseph Davis would present Life Membership Certificates to C. H. Love and J. J. Yager at the May meeting, and he also presented the slate of officers nominated by the Board of Governors for 1952-53.

P. H. Shober of the General Coal Co. spoke on the role the bituminous coal industry plays in the country's economy. He then presented an excellent colored film, prepared by the *March of Time*, showing the various phases of coal mining and processing. Attendance 33.

• *WISCONSIN*—April 21, 1952. Members and guests met in the Capital Hotel, Madison, for a social hour and dinner, followed by a business meeting, which was called to order by Pres. H. F. Brinen. The minutes of the March meeting were read and approved, and Vice Pres. J. A. Lofte announced that the May meeting would be held on May 19 at the Pfister Hotel. The meeting, which would be Ladies Night, would feature a short talk by the Society President, Ernest Szekely, and a talk by Professor Hougen on *The Charm of Norway*. L. C. Plaehn submitted the membership committee's report, and E. W. Gifford, chairman of the nominating committee, submitted that committee's report. The following auditing committee was appointed: R. G. Koch, O. J. Ress, and J. E. Sweet.

C. B. Rowe, chief research engineer, Research Products Corp., Madison, Wis., spoke on *Rating, Selection and Use of Panel Type Air Filters.* Mr. Rowe began his talk by pointing out that there were three common methods of rating filters as to their efficiencies, which include: (1) weight of dust in the filtered air *vs.* the unfiltered air; (2) rating method set up by the *Bureau of Standards* based upon discoloration of a standardization pad by the filtered air; and (3) a particle count of the dust and impurities in the filtered air. Mr. Rowe also pointed out that these various rating methods produced some rather unusual results and that the TAC on Air Cleaning has been working on a standardization filter rating arrangement.

Mr. Rowe showed a series of slides, the first of which illustrated the methods used rating filters by weight of dust. This equipment consisted of a blower and a duct system, so that test dust introduced into this duct system would pass through the filter being tested and then through an absolute filter which is over 99 percent efficient in withholding any test dust which passes the filter being tested. The filter is weighed before the test begins, and the test lasts one hour. The exact weight of dust which is injected into the air stream is weighed and the increase in weight (of the filter being tested) is compared against the initial dust injection on a weight basis.

Mr. Rowe stated that efforts are being made to standardize test dust, and that he generally favors a dust consisting of 80 percent of Pocahantas coal fly ash, which will pass a 200-mesh screen, and 20 percent double bolted carbon black. Another type of test dust which is commonly used is one known as Arizona road dust which meets certain requirements with regard to fineness. Still another type of test dust is Kapok linters which will pass a 28-mesh screen. The last type of dust mentioned and which Mr. Rowe recommended highly is a mixture of 95 percent of Pocahantas coal fly ash

and 5 percent of the finely ground Kapok linters.

Mr. Rowe mentioned that filters could be classified as the replaceable type, the type which can be re-used after cleaning, and electrostatic filters.

With regard to application of filters, he stated that there are five broad applications, one of which is residential and similar use on small heating and ventilating systems, another is for air conditioning units of the self-contained type, and others include central ventilating and air conditioning systems. A question and answer period followed the talk, and the meeting concluded with a rising vote of thanks to Mr. Rowe. Attendance 15. Attendance ratio 0.23.

• *WISCONSIN*—March 17, 1952. Pres. H. F. Brinen called the meeting to order in the Engineering Society of Milwaukee Building, following dinner. The minutes of the February meeting were read and approved, and Vice Pres. J. A. Lofte announced that the next meeting would feature an address by C. B. Rowe. President Brinen announced that the Semi-Annual Meeting would be held June 16-18 at Spring Lake, N. J. He also announced the selection of the following nominating committee: E. W. Gifford, chairman, F. J. Nunlist, Jr., and H. W. Schreiber.

The speaker of the evening was N. E. Bueter, consulting engineer, Chicago, Ill. Mr. Bueter outlined some of the past practices of the consulting engineering profession and pointed out that approximately 25 years ago a good deal of the engineering work was done by representatives of firms manufacturing heating equipment and heating specialties. This type of free engineering service is slowly beginning to disappear in favor of independent consulting engineers who are paid a percentage fee for the engineering work for any given project.

Mr. Bueter stated that many years ago all of the mechanical equipment for a given building represented approximately 10 percent of the total cost of the building construction. During recent years the percentage of costs going into mechanical equipment has continually increased, and it is not unusual today to find some buildings where the cost of mechanical equipment will run more than 50 percent of the total construction cost.

He then outlined the efforts of the consulting engineers in the Chicago area to raise the standard of engineering work which is being done and to set up a fair trade code for consulting mechanical engineers. He outlined the responsibilities of the consulting engineers as well as those of the contractors. Mr. Bueter also pointed out the great difficulty which was experienced in Chicago in bringing together representative groups of the various mechanical contractor associations with the consulting engineering groups.

Mr. Bueter brought out the fact that the *AIA* had set up some rather standard fees for architects, but that many architects still shop around for extremely low fees for having the engineering work done. Difficulty often arises because at times the architect insists on supervising the installation of the mechanical equipment when actually a consulting engineer who has designed the system, would be much better qualified to supervise.

Mr. Bueter stated that architects and structural engineers were the only people in the State of Illinois who could secure a permit for a new project. He pointed out the importance of securing greater recognition for consulting mechanical engineers in their design work and the need for recognition of properly qualified engineers with regard to securing permits and meeting the other qualifications legally required for new construction. Following the discussion period, the meeting was concluded with a rising vote of thanks to the speaker. Attendance 54. Attendance ratio 0.26.

STUDENT BRANCHES

• *NORTH CAROLINA STATE COLLEGE*—February 21, 1952. Pres. Sydney Narvey called the joint meeting with the *ASME* and *SAE* Student Branches to order at 7:15 p.m.

There being no business to be transacted, President Narvey introduced Prof. T. C. Brown, who in turn introduced the speaker of the evening, Frank Carter, Detroit Lubricating Co. Mr. Carter spoke on the use of expansion valves in a refrigeration system and the problems confronted in their use. The talk was illustrated with slides. Attendance 21. Attendance ratio 0.32.

• *NORTH CAROLINA STATE COLLEGE*—February 5, 1952. Pres. Sydney Narvey called the meeting to order at 7:00 p.m. in the Broughton Engineering Laboratory. The minutes of the previous meeting were read and approved; and the treasurer submitted the financial report.

It was decided to sponsor a joint meeting with the *ASME* Student Branch on February 21. A motion was made and seconded to hold a dinner meeting on February 25 in honor of Prof. C. A. McKeeman, Student Branch advisor and head of the College's Heating and Ventilating curriculum, who was leaving the College to go into industry. It was further agreed to present Professor McKeeman with a cigarette lighter from the North Carolina State College ASHVE Student Branch. Attendance 10. Attendance ratio 0.30.

• *NORTH CAROLINA STATE COLLEGE*—January 15, 1952. The meeting was called to order in the Broughton Engineering Laboratory by Pres. Sydney Narvey. The roll was called, and the minutes of the previous meeting were read and approved.

L. R. Wensil, Jr., introduced the speaker of the evening, Mr. Clark, resident engineer of the North Carolina State College construction program. Mr. Clark told of the problems confronted in the construction of the various classrooms and laboratories on the west campus. He also told of the problems involved in installing heating systems in the college buildings and explained how the problems were solved. Attendance 20. Attendance ratio 0.56.

Personal Notes

CLYDE A. MCKEEMAN, professor of mechanical engineering at North Carolina State College, Raleigh, N. C., has been named director of the

C. A. McKeeman

Heating and Cooling School organized recently by the American Radiator & Standard Sanitary Corp., Buffalo, N. Y. The courses in the school will follow a plan of study devised by Mr. McKeeman, and it is planned to make the courses available to the industry's wholesalers and retailers.

Mr. McKeeman served as assistant to the president of ASHVE for two and a half years and just prior to accepting the ASHVE appointment he was director of supervisory training for Thompson Products Co., Cleveland, Ohio. For over 18 years he was an associate professor of mechanical engineering and faculty member at Case Institute of Technology, and was also director of its evening division. During World War II he was director of the Institute's war training program.

F. W. Hutchinson

F. W. HUTCHINSON, Berkeley, Calif., a member of the faculty of the University of California and authority on heating and air conditioning, has been retained by the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., as marine consultant, according to a recent announcement by J. E. Haines, vice president in charge of the company's Commercial Controls Division.

Professor Hutchinson also served as consultant to a number of steamship companies and has done considerable work for the Navy, including such fields as comfort and health requirements in crew and passenger spaces, temperatures, humidity and ventilation requirements to prevent cargo damage. He recently completed an eight-month trip around the world studying the engineering methods of the merchant marine.

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C. M. BARNES, Chicago, Ill., has been appointed editor of *American Artisan*, according to a recent announcement by Keeney Publishing Co., Chicago. Mr. Barnes has been director of the Air Conditioning School of the Industrial Training Institute, Chicago. Prior to World War II, in which he served as a Flight Engineer in the U. S. Air Force, he was department supervisor in the Air Conditioning Section of the Institute from 1938 to 1941.

His background has been teaching, writing, and lecturing on warm air heating, residential air conditioning, and sheet metal contracting, which constitute the field of *American Artisan*. His courses have also covered the design, installation and servicing of heating, ventilating and air conditioning systems, with emphasis on the residential applications of these services as well as on all types of structures. Mr. Barnes' previous experiences have also included installation and service work on refrigeration so that he is thoroughly grounded in the development of summer cooling.

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HARRY E. LEWIS, New York, N. Y., has been appointed executive director of the *Industrial Mineral Wool Institute*, as announced by G. J. Christner, president of the Institute. Just prior to this appointment, Mr. Lewis was general manager of the In-

H. E. Lewis

dustrial Sales Department, Perlite Division, Great Lakes Carbon Corp., New York. He was formerly manager of the Insulation Engineering Department of The Eagle-Picher Sales Co., Cincinnati, Ohio, and was associated for a time with the Owens-Corning Fiberglas Corp., Toledo, Ohio.

Mr. Lewis, a member of the Technical Committee of the Institute from the time it was founded in 1941 until 1949, continued to take an active interest in Institute affairs since that time. He will maintain offices at the Institute's headquarters, 441 Lexington Ave., New York 17, N. Y.

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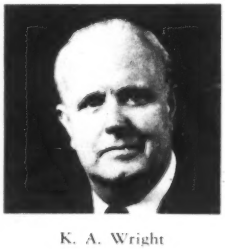
KENNETH A. WRIGHT, Cincinnati, Ohio, J. REXFORD VERNON and PAUL D. GAYMAN, both of Milwaukee, Wis., have been elected vice presidents of



K. A. Wright

Johnson Service Co., Milwaukee, according to a recent announcement by J. A. Cutler, president.

Mr. Wright, who has been manager of the company's Cincinnati branch

P. D. Gayman

since 1920, has also been appointed manager of the Central District, with headquarters in Chicago, and comprising branch offices in the area extending from Pittsburgh to Omaha and south to the Gulf of Mexico. Mr. Wright, who served in the U. S. Army Chemical Warfare Service during World War I, joined the company in 1919, and served in the branch offices in Kansas City, Pittsburgh, and San Francisco, before going to Cincinnati.

Mr. Gayman will also continue in his post as manager of the Western District, which includes branches in the Pacific Coast, mountain, and northwestern states. Following a year with Fosdick and Hilmer, consulting engineers, he joined Johnson Service in 1927, and served as manager of the Indianapolis branch from 1929 to 1938, and as manager of the Cleveland Branch from 1938 until his appointment as western district manager.

Mr. Vernon, as well as being a vice president, will continue as sales promotion manager. A graduate of the Engineering College of the University of Wisconsin, Mr. Vernon served as a lieutenant in the Corps of Engineers in World War I. Following his discharge he worked for the State of Wisconsin, and in 1923 joined Johnson Service. He served as sales engineer in the Chicago office for 11 years, before becoming manager of sales promotion and advertising. He also served the company in the capacity of secretary and assistant secretary.

J. R. Vernon

CHARLES H. BURKHARDT, New York, N. Y., has resumed his position as heating editor on the *Plumbing and Heating Journal*, *Plumbing and Heating Wholesaler*, and on the *Sheet Metal Worker*, after a nine-month leave of absence, during which time he served as industrial specialist in charge of automatic firing devices for the National Production Authority, Washington, D. C.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 99 applications for membership, including 1 student application and 1 reinstatement; in addition 16 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by June 30, 1952, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

Arizona

SCOTT, J. E., Sr. Indus. Engr., Reynolds Metal Co., Phoenix. REFERENCES: H. L. Baker, Jr., F. F. Groseclose*, A. D. Holland*, H. W. Mason*.

Arkansas

ZACHER, N. J., Chief Engr., A. W. Johnson Co., Texarkana. REFERENCES: C. M. Hadra, M. A. Hudson, J. S. Malahy, Jr., P. O. Rottman.

California

BENROW, D. C., Partner, Park Sheet Metal Works, Sacramento. REFERENCES: John Day*, T. W. Johnston, N. N. Leas, C. D. Williams.

BLANCHARD, D. R., Estimator & Engr., M. R. Carpenter, Sacramento. REFERENCES: R. C. Cushing, L. A. O'Meara, N. H. Peterson, T. J. White.

BOOTH, F. M., Owner, Frank M. Booth, Marysville. REFERENCES: J. E. Marshall, L. A. O'Meara, C. A. Otto*, G. L. Sullivan*.

DAY, J. E., Mgr., Htg. Dept., Heieck & Moran, Sacramento. REFERENCES: R. C. Cushing, J. E. Marshall, J. E. Murray, E. C. Sanford.

DENNER, W. C., Mgr. Slakey Bros., Inc., Modesto. REFERENCES: T. W. Johnston, J. O. Martin, L. A. O'Meara, E. C. Sanford.

DEWITT, A. N., Asst. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: A. M. Berlin*, J. E. Marshall, L. A. O'Meara, Arthur Roth.

JOURNAL SECTION

DOOLITTLE, S. W., Mech. Engr., Lester A. O'Meara, Cons. Mech. Engr., Sacramento. REFERENCES: J. E. Marshall, J. N. Moore, L. A. O'Meara, R. A. Sarro.

FONG, SAMUEL, Asst. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: K. O. Alexander, J. E. Marshall, Arthur Roth, V. W. Thornburg.

GILLET, C. A., Sales Engr., Neil H. Peterson Co., San Francisco. REFERENCES: K. O. Alexander, H. V. Hickman, J. E. Murray, N. H. Peterson.

GLAZE, R. V., Mech. Engr., Lester A. O'Meara, Cons. Mech. Engr., Sacramento. REFERENCES: D. R. Blanchard, J. E. Marshall, J. N. Moore, L. A. O'Meara.

HAWLEY, F. E., Jr. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: K. O. Alexander, J. E. Marshall, Arthur Roth, V. W. Thornburg.

JOZENS, J. J., Assoc. Archt., Leonard F. Starks, Sacramento. REFERENCES: C. E. Bentley, S. R. Lewis, J. E. Murray, L. A. O'Meara.

KLEINBERG, L. R., Gen. Mgr., Health-Aire, Culver City. REFERENCES: J. L. Blake, Leo Hungerford, Stanley Polland, R. C. Snow.

LANDER, W. B., Mech. Engr., Corps of Engrs., U.S. Army, Sacramento. REFERENCES: M. J. Delavan*, E. C. McKinsey, J. N. Moore, E. E. Phillips.

LENZ, W. C., Mgr., Construction & Service, McClellan Field, McClellan. REFERENCES: Bert Greene*, Howard Hansen*, R. L. Hinshaw*, J. E. Marshall.

LEWIS, H. B., Owner, Lewis & Lewis, Placerville. REFERENCES: C. F. Dean*, H. J. Devine*, D. M. Hoffman*, J. P. Morton*.

MARTINA, R. A., Asst. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: K. O. Alexander, G. O. Fowble, J. E. Marshall, Arthur Roth.

MCKINSEY, E. C., Chief Mech. Engr., Corps of Engrs., U. S. Army, Sacramento. REFERENCES: E. M. Anderson*, W. B. Lander, J. R. Morton*, E. E. Phillips.

MOORE, J. N., Estimating, Romack Plumbing Co., Sacramento. REFERENCES: W. L. Johnson, J. E. Marshall, B. A. Sarro, B. C. Watts, Jr.

MULDOON, H. E., Asst. Mgr., Crane Co., Sacramento. REFERENCES: H. E. Lemkau, J. E. Marshall, L. A. O'Meara, N. H. Peterson.

NICHOLS, C. H., JR., Jr. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: J. E. Marshall, L. H. Mullen*, Arthur Roth, V. W. Thornburg.

PERRY, F. R., Asst. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: J. E. Marshall, L. H. Mullen*, Arthur Roth, V. W. Thornburg.

PETERSON, D. R., Estimator, Fontaine & Bean, Sacramento. REFERENCES: Frank Burk*, W. C. Denner, R. L. Fontaine*, M. J. Kodmur.

PHILLIPS, E. E., Mech. Engr., Corps of Engineers, McClellan Field, McClellan. REFERENCES: R. C. Cushing, E. C. McKinsey, L. A. O'Meara, Arthur Roth.

ROMACK, G. F., Supt., Romack Plumbing Co., Sacramento. REFERENCES: S. W. Doolittle, T. W. Johnston, J. E. Marshall, L. A. O'Meara.

ROTH, ARTHUR, Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: K. O. Alexander, J. E. Marshall, L. A. O'Meara, N. H. Peterson.

ROUTHIER, A. J., State of California, Div. of Architecture, Sacramento. REFERENCES: D. W. Dahlquist*, J. E. Marshall, L. H. Mullen*, Arthur Roth.

SANFORD, K. C., Mech. Engr., L. A. O'Meara, Cons. Mech. Engr., Sacramento. REFERENCES: D. R. Blanchard, J. E. Marshall, J. N. Moore, L. A. O'Meara.

SARRO, R. A., Mgr., Htg. Dept., Tay-Holbrook, Inc., Sacramento. REFERENCES: J. E. Marshall, J. N. Moore, L. A. O'Meara, George Sullivan.

SHEA, L. E., Sales Repr., The National Radiator Co., San Francisco. REFERENCES: Maurice Archer*, L. N. Hunter, J. E. Murray, H. D. Page.

THORNBURG, V. W., Assoc. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: K. O. Alexander, J. E. Marshall, L. A. O'Meara, Arthur Roth.

Colorado

WILLS, J. H., Chief Engr., Richards-Conant, Denver. REFERENCES: A. B. Conant*, William Hanson*, Frank Spillers*, P. C. Von Rosenberg.

Connecticut

LIPSKI, W. L., General Project Engr., Tuttle & Bailey, Inc., New Britain. REFERENCES: W. L. Batchelor, J. H. Smart, R. D. Tutt, Leonard Zavorski.

Georgia

CHEEK, C. T., Asst. Mgr., The Lennox Furnace Co., Decatur. REFERENCES: F. E. Hockensmith, J. G. Mauldin, V. C. Ramseur, Jr., T. H. Smoot.

DELAY, G. R., Engr., Newcomb & Boyd, Cons. Engrs., Atlanta. REFERENCES: D. H. Armstrong*, S. W. Boyd, Eugene Clary*, R. S. Newcomb.

Illinois

△ANDERSON, H. E., Partner, Anderson & Litwack Co., Chicago. REFERENCES: M. W. Bishop, J. B. Hashagen, J. S. Kearney, W. A. Kuechenberg.

△BURGESS, R. H., Dir., Research & Dvlpt., Drying Systems Inc., Chicago. REFERENCES: M. J. Bamond, G. G. Freyder, L. L. Narowetz, Jr., G. V. Zintel.

△CLARK, J. E., Chief Engr., General Blower Co., Morton Grove. REFERENCES: F. P. Bleier, H. J. Johnston*, L. E. Schulein, G. F. Spooner.

△CUMMISKEY, J. F., Commercial Mgr., Minneapolis-Honeywell Regulator Co., Chicago. REFERENCES: J. H. Clarke, S. R. Lewis, S. I. Rottmayer, E. E. Sundeen.

GILKEY, H. T., Research Assoc., Dept. of Mech. Engrg., University of Illinois, Urbana. REFERENCES: M. K. Fahnestock, S. F. Gilman, S. Konzo, R. W. Roose.

△IMMING, C. A., Vice Pres., O. A. Wendt Co., Chicago. REFERENCES: M. W. Bishop, H. G. Chapin, R. E. Hattis, W. A. Kuechenberg.

△INOUYE, TOHRU, Research Asst., University of Illinois, Dept. of Medicine, Chicago. REFERENCES: M. K. Fahnestock, Nathaniel Glickman, E. P. Heckel, R. W. Keeton, M.D.

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L. G. VANCE, CHARTER MEMBER BALTIMORE CHAPTER, DIES

Louis G. Vance, Charter Member of the Baltimore Chapter and Life Member of the Society, died on February 22, 1952, according to word

L. G. Vance

recently received at the Society headquarters office.

Mr. Vance was born in July 1878 at Madison, Ind. He received his drafting experience in the Engineering Department of Crane Co., Chicago, Ill., and in the years following worked for such firms as E. A. Vance Construction Co., Cincinnati, Ohio, the F.E.C. Railroad as chief property clerk on constructions, American Radiator Co., Pierce Butler & Pierce Mfg. Corp., Spencer Heater Co., Philadelphia, Pa., and with the U.S. Housing Corp., Washington, D.C., as assistant buyer.

He was a Manufacturers' Agent from 1915, representing various companies in design and sales of heating and ventilating equipment, and in 1920 he was appointed Baltimore District Manager of Warren Webster & Co.

Prior to his death, Mr. Vance represented the Ross Heater & Mfg. Co., Inc., Buffalo and the Ric-wiL Co., Cleveland, in heat transfer problems.

Besides being a member of the ASHVE, he also held membership in the *Air Conditioning, Heating and Ventilating Engineers of Baltimore* and the *American Society of Naval Engineers, Inc.*, of Washington, D.C.

The Officers and Council of the Society extend their sincere sympathy to his widow, Mrs. Ethel K. Vance.

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OSCAR G. WARD, CHICAGO, DIES SUDDENLY

Oscar G. Ward, Chicago, Ill., a member of ASHVE for over 22 years, passed away on Saturday, April 12, at Evanston Hospital, Evanston, Ill.

Mr. Ward was born on July 25, 1887 at Wayne, Wis. He joined the Johnson Service Co., Milwaukee, following his graduation in mechanical engineering from the University of Wisconsin, and after 40 years of service in the company was retired on April 1, 1952.

He located originally in Omaha, then went to the Kansas City office, and later managed the Cleveland Branch for Johnson Service. In 1919, he became branch manager of the Denver office, where he was credited with an outstanding job of development in the mountain country from border to border. He managed the Denver branch for 20 years, and has been vice president and manager of the central district since 1938.

Mr. Ward was honored recently by the Johnson Service officials at a luncheon in Chicago's Lake Shore Club, and in commenting on his long and successful record, J. A. Cutler, president of the company, said: "His experience and knowledge have been relied upon by his associates for many years, and they regret the fact that his guidance no longer will be available. O. G.'s many friends in the heating and air conditioning industry wish him good health and

O. G. Ward

happiness in his well-earned retirement."

The Officers and Council of the Society extend their profound sympathy to Mr. Ward's widow, Mrs. Elizabeth Ward, to his son, Sgt. Oscar G. Ward, Jr., of the U.S. Marines, and to the other members of his family.

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Group B — Heat Transfer Between the Panel and the Space: J. M. van Nieukerken, *Chairman;* C. O. Mackey*, *Vice Chairman;* C. M. Ashley, C. F. Boester*, W. P. Chapman, W. S. Harris, Linn Helander, J. W. James, A. T. Jorn, C. F. Kayan, H. A. Lockhart*, W. E. Long, R. L. Maher, R. A. Miller, D. L. Mills, G. L. Wiggs.

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● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 212 Robinson Bldg., 160 Union (3).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Bereman, Box 95, Riverdale Sta. (5). SECRETARY, D. E. Tullis, 1720 Park Pl. (6).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, G. W. Akers, Box 238, R.F.D. 2, Rochester. SECRETARY, R. H. Oberschulte, 316 McKerchey Bldg. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, William Sturm, 2160 Highland Pkwy., St. Paul (5). SECRETARY, J. G. Hamm, 850 Cromwell Ave., St. Paul (4).

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, W. G. Hole, 140 Prince St. SECRETARY, D. L. Lindsay, 1411 Crescent St. (25).

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, K. E. Martin, 204 Barker Bldg. (2). SECRETARY, O. J. Smith, 255 Grain Exchange Bldg. (2).

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● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, R. E. Allison, 607-11 First Ave. (10). SECRETARY, M. W. Brown, 1215 Texas Bank Bldg. (2).

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● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, John Richmond, 10210 Woodland Ave. (4). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs. Greensboro, N.C. PRESIDENT, L. L. Vaughan, P.O. Box 5746, Raleigh. SECRETARY, J. W. Bunn, Jr., 2705 Lochmore Dr., Raleigh.

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● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, M. C. Greiner, 1559 Club View Dr. (24). SECRETARY, L. B. Davenport, 137 S. Anderson St. (33).

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● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, First Wednesday. PRESIDENT, D. R. Wilde, 2634 S. 10th E. (5). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

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● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, S. R. Allen, 942 Washington Bldg. (5). SECRETARY, P. H. Loughran, Jr., 4513 49th St., N.W. (16).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, W. C. DeRoo, 500 E. 8th St., Holland. SECRETARY, P. D. Winchester, 322 Columbia Ave., Holland.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, J. M. Quackenbush, 505 Franklin St. (2). SECRETARY, Q. P. Thompson, 298 Barton St. (14).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lotte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, L. J. Rossiter, 251 W. Wisconsin (4).

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● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 518 Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 5333, Bagwell Dormitory.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, Stuart Cohen, 513 ½ Knoblock. SECRETARY, H. G. Rice, 5 Chickasha, Box 417, Vets Village.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, D. W. Blair, 225 W. 15th St. SECRETARY, C. D. Cannon, 404 N. 26th St.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, G. H. Williams, 18251 Washburn (21). SECRETARY, R. H. Drake, 5598 Hurlbut (13).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Coy, 560-D Deep Eddy Apts. SECRETARY, V. H. Miles, PHP Dorm J.

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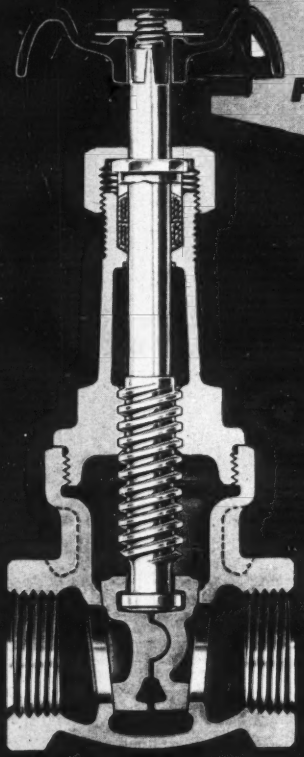

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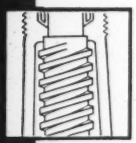

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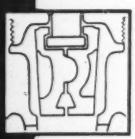

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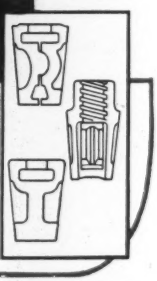

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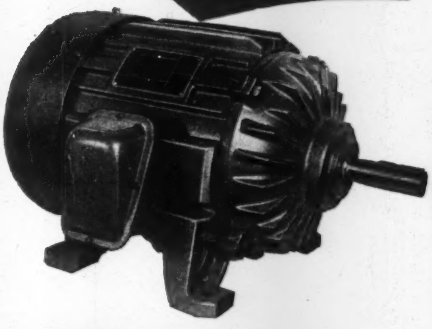

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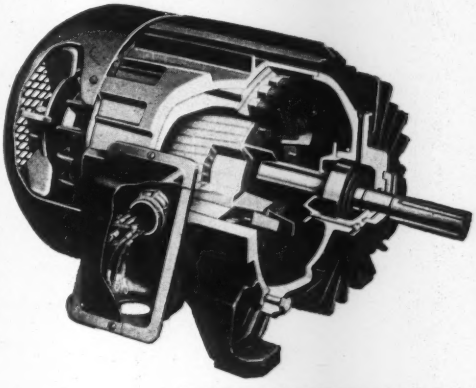

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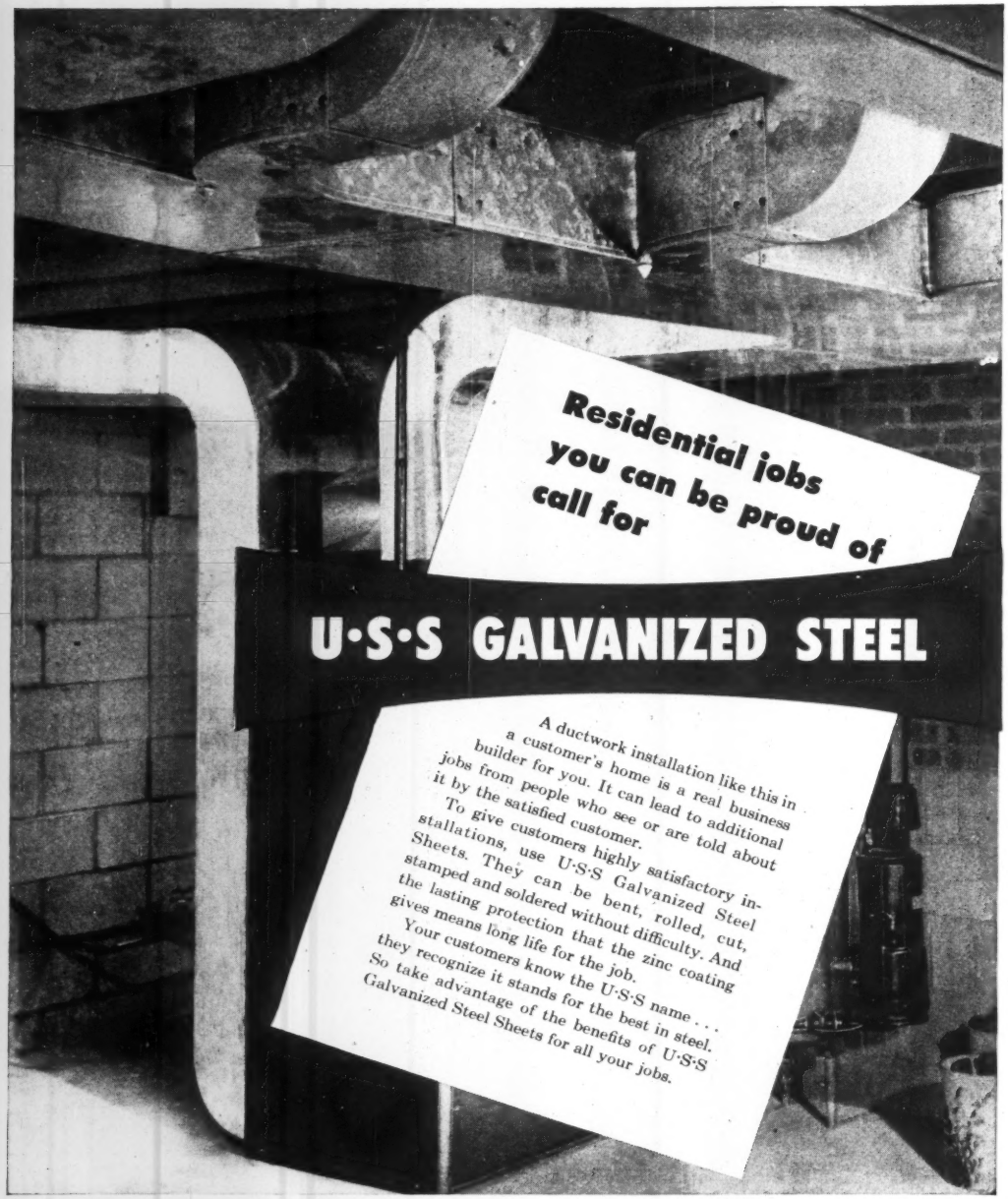
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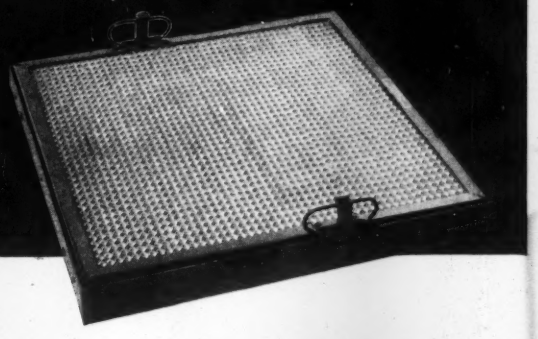
E·Z·Wash AIR FILTERS



Quickly Cleaned... Easily Re-oiled!

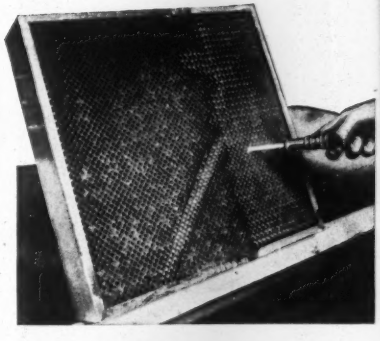
CONTINENTAL *E·Z·Wash* filters are *the only cleanable air filters which require no hot water, detergents or special cleaning tanks.* Cold water under normal line pressure . . an ordinary garden hose and spray nozzle . . are all that are needed for easy, rapid and efficient cleaning. You save with CONTINENTALS.

After cleaning, CONTINENTAL *E·Z·Wash* filters can be re-oiled very quickly and easily. Charge CONTINENTAL filters by dipping them or by spraying with any commercial, air operated oil-spray gun. For either method use CONTINENTAL C-5 filter oil.

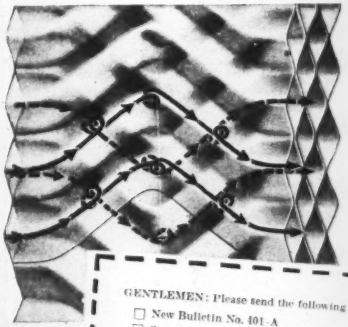
Continental *E·Z·Wash* filters are available in capacities from 950 to 1850 CFM . . in a range of standardized sizes.

Low maintenance is a major advantage in CONTINENTAL *E·Z·Wash* filters. High efficiency in air cleaning and low resistance to air flow are further advantages of these remarkable filters which save time and labor.

Write for full details today!



TOP: Convenient latchhandles facilitate quick removal of Continental E • Z • Wash unit filters for cleaning.



ABOVE: The E • Z • Wash unit filter can be quickly and thoroughly cleaned with an ordinary hose using cold water.

LEFT: Cross-section diagram of Continental patented filter media showing turbulent air flow, which results in extremely high air-cleaning efficiency and continuous exceptionally low resistance.

GENTLEMEN: Please send the following:

☐ New Bulletin No. 401-A

☐ Sample of E • Z • Wash Air Filter Media

NAME _____

FIRM _____

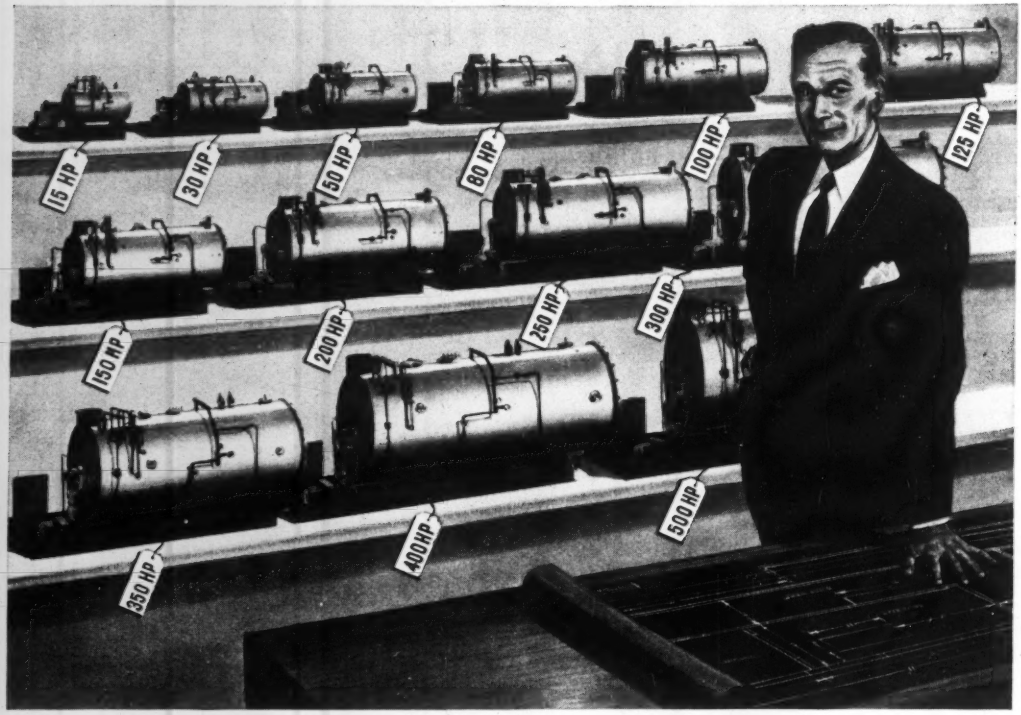
STREET _____

CITY _____ STATE _____

CONTINENTAL AIR FILTERS, Inc.

P. O. BOX 1647 • LOUISVILLE 1, KY.

Selecting The Right Boiler Is Most Important...

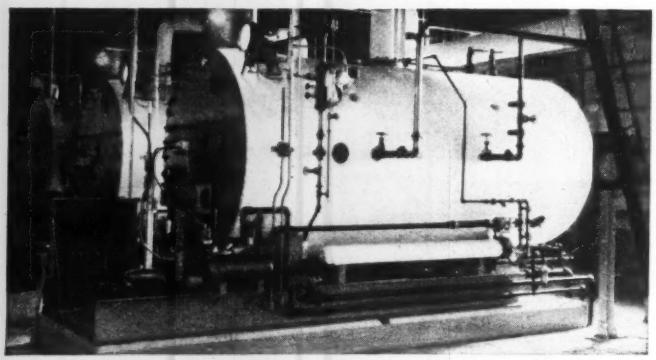


Cleaver-Brooks does not sell steam boilers "off the shelf" even though the boilers are available in standard models. Working with you, your engineers, and your consulting engineers Cleaver-Brooks helps analyze your particular steam needs and loads, both present and future.

These are a few of many factors considered: steam requirements in pounds per hour or b.h.p. — constant or fluctuating loads — fuels available — electric current characteristics — space and boiler room layout — provision for expansion.

Application engineering assistance of this kind assures you a steam plant tailored for your job. Cleaver-Brooks are the first and finest in modern, self-contained steam boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 250 p.s.i.

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.



Cleaver-Brooks

STEAM BOILERS

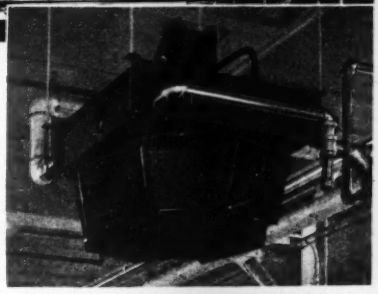
CLEAVER-BROOKS COMPANY
Dept G, 312 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

One Sure way to "Keep 'em Happy" is to Keep 'em COMFORTABLE

from
WALL STREET JOURNAL
April 28, 1952

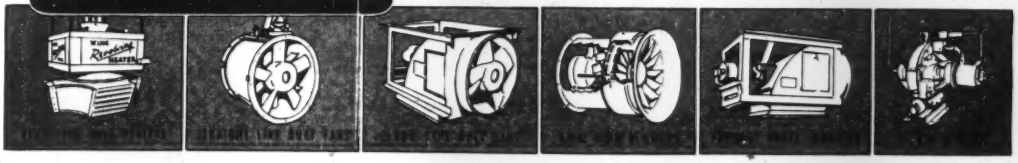
The happiness of the worker is more than just a phrase, as the news item from the WALL STREET JOURNAL shows. That management recognizes the value of a happy employee is shown by the various incentives over and beyond the matter of wages that are being offered in plants all over the country. One important "incentive" that can be offered without extra cost is the feeling of comfort, provided by the adoption of a heating system that insures an atmosphere of fresh, live, invigorating warmth—Wing REVOLVING Unit Heaters. A "heating" system that in summer can become a "cooling" system—with steam off and fans on, the revolving discharge outlets provide a pleasant cooling effect that is the nearest approach to full air conditioning available today. Thousands of plants in all parts of the country have adopted Wing Revolving Unit Heaters. Why not yours? *Write for a copy of Bulletin HR–6*



The discharge outlets of the Wing Revolving Unit Heaters revolve slowly, distributing the heated air downwards in gently moving streams, that can be adjusted for different shapes of areas to be covered. In the summer time, with the heat turned off they act as a perfect air cooling system.

Wing
REVOLVING UNIT HEATERS

L. J. Wing Mfg. Co. 140 Vreeland Mills Road, Linden, N.J.
Factories, Linden, N. J. and Montreal, Canada
In Europe: Etablissements WANSON, Haren-Nord, Brussels, Belgium



STAINLESS STEEL
ALUMINUM

NEED METALS?

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INCONEL* BRASS
NICKEL*
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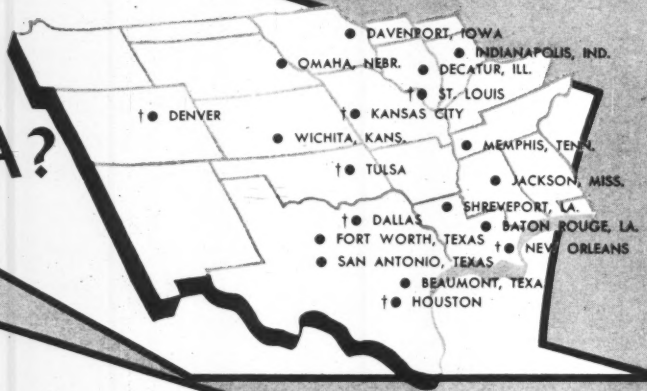
STEEL

Sheet, Plate, Tube, Pipe, Wire, Rod and Bar, Extrusions, Structural Shapes . . . and the following INDUSTRIAL PRODUCTS: Fasteners, Tube Fittings, Pipe Fittings, Valves, Silver Brazing Alloy, Welding Material, Solder, Castings, Tube Expander Equipment, Liquid Plastic Protective Coating, Metallic Caulking Compound, Aluminum Metal Trim, Waterproof Barriers, Nails, Handrail Fittings, Low Melting Alloys, Aluminum Jacketing, Wire Cloth and Rope, and "O" Rings.

Precision Equipment for Shearing and Slitting.

*Not stocked in Kansas City or St. Louis territories.

IN THIS AREA?



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Markings mean just what they say on WeldELLS®

A VOLUME OF USEFUL DATA ON A SINGLE SHEET—Sizes, thicknesses and dimensions of all commonly used WeldELLS and Taylor Forged Steel Flanges ingeniously condensed on a heavy durable, letter-sized card. Indispensable for piping men. Coupon brings free copy.

No other fittings for pipe welding are so true to their markings as WeldELLS — so absolutely uniform, mechanically, metallurgically, dimensionally.

It would be bad business for us to say this if thousands of users had not already said it for us and to us. "There are no bad ones" is nearly always the foremost reason given by practical men for insisting on WeldELLS.

Pick up any WeldELL and check it against the tabulation of its size, wall thickness, and other dimensions. It will be right on the head. And it will be right on the head in plus-value features, too—features that are combined in no other fittings.

Remember that the finest line of welding fittings is also the broadest line. Coupon brings your copy of useful data described below.

TF

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TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Ill.
Offices in all principal cities
Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

Please send a copy of your data sheet covering Taylor Forge Welding Fittings and Forged Steel Flanges.

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POSITION_____

COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

510-0652 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

FOR ABOVE...

Present government regulations still allow you to install copper water tube for hot and cold water lines.

Chase Copper Water Tube's resistance to corrosion makes it the number one choice for domestic water lines.

OR DOWN UNDER

Underground piping of Type K Chase Copper Water Tube resists the double corrosive action of earth on the outside and water inside.

The easy-to-install coiled lengths of 40, 60 and 100 feet require fewer fittings... and its soft temper permits bending around obstructions.

...it's Chase Copper Water Tube

Since government regulations do not prohibit the use of copper for domestic hot and cold water lines, or underground service lines, it's wise to plan the use of Chase Copper Water Tube for these two important types of installation.

Chase Copper Water Tube is made in hard and soft tempers for use with both solder-joint and flared fittings.

Rustproof, corrosion resistant, easily worked, smooth interior for better flow —these are some of the reasons why Chase Copper Water Tube is ideal for long life, fine service.

Chase BRASS & COPPER

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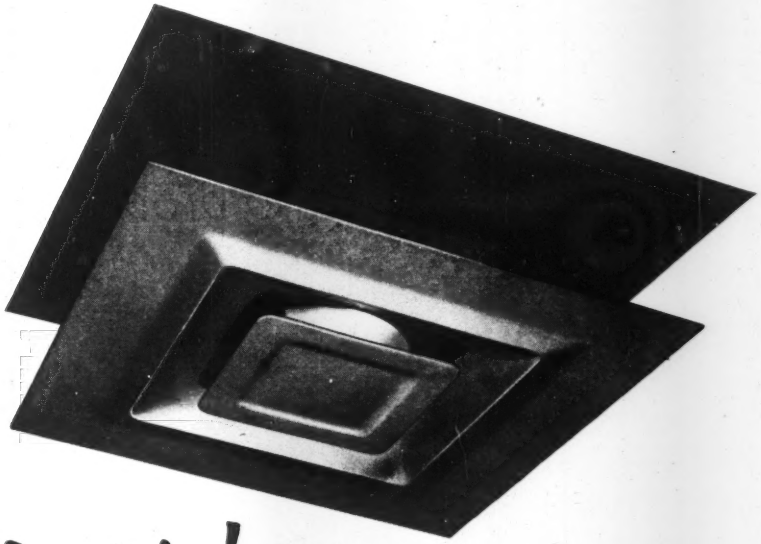

Here it is!

the new **kno·draft** square diffuser

Even before we could get this announcement into print, word of this new Kno-Draft *Square* Diffuser got around. We've been filling orders from all over. The air conditioning folks who have seen it and installed it are plenty enthusiastic. And no wonder —

Here in this smart, efficient *square* unit are the advanced engineering characteristics that have made the standard round Kno-Draft Air Diffuser famous — built-in volume control, precision circular air patterns, sturdy construction, and others.

You can get the new *square* Kno-Draft in two brilliantly conceived modern designs — both for quick, easy installation. *Type KP* features overlap style construction. *Type KPT* is designed for T-bar installations, snapping snugly into perforated acoustical-type ceilings.

You can get complete engineering data on the new, already popular, Kno-Draft *Square* Diffusers quickly. Just mail the coupon today.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

W.B.CONNOR ENGINEERING CORP.
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Air Diffusion • Air Purification • Air Recovery
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Please RUSH full information on the new Kno-Draft *Square* Diffusers.

Name .....
Position .....
Company .....
Street .....
City ..... Zone .... State .....

"More living room is no problem with this hideaway furnace"

says, R. C. (Andy) Anderson,

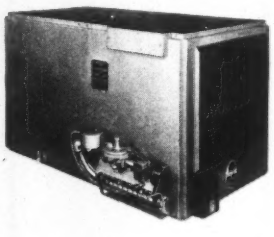
Bryant-Anderson Company, Houston, Texas

With usable space at a premium, it is little wonder that the Bryant *Hideaway* Gas Furnace is proving so popular. Architects and builders say it not only saves valuable space, but the furnace, itself, is a real selling feature.

Tucked away in the attic—or suspended from the ceiling or under the floor—this dependable forced-air furnace provides a world of comfort for householders while releasing *extra space* for storage, utility purposes or plain *living*.

The *Hideaway* is a true Bryant product—long on dependability and gas economy, and with positive automatic control. Naturally, the casing temperatures are low. You'll also like the way it goes in—structural steel mounting channels come with it and can be used to suspend the unit when it is so-installed.

Yes, you'll like this Bryant *Hideaway* Forced-Air Furnace that gives you both added living space and better heating. Why not ask your Bryant Distributor for full details? Or write Bryant Heater Division, Dept. 123, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, Ohio.



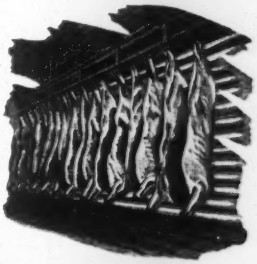
Bryant Model 324
Hide-away Gas Furnace

Can be tucked away in the attic, or suspended from ceiling or under the floor. Fully automatic, forced-air unit with *Hevigage* heat exchanger. Available for all gases. AGA inputs: 65, 85, 100 and 125 thousand Btu per hour.

bryant *best buy*

IN HEATING,
AIR CONDITIONING,
WATER HEATING

Quality... in Quantity



W-S Forged Steel Fittings

SCREW-END and SOCKET-WELD TYPES

Wherever liquids or gases are conveyed for cooling, heating, or refrigeration, Watson-Stillman FORGED Steel Fittings mark the modern, long-life, low *service*—cost lines to greater operating economy.

Quality—in Quantity—has earned and sustained the Watson-Stillman position of first-to-see when industry seeks a solution to a specific fittings problem. Despite an enormous increase in the use of its low *service* cost fittings, Watson-Stillman has never relaxed its concern for the metallurgical aspects of product development.

First to identify itself with the establishment of standards for the properties of special purpose fittings alloys, Watson-Stillman technicians continue in close association with the engineering research efforts of a score of basic industries . . . will be glad to lend a hand on *your* next fittings problem.

9-M-3

• **Stronger** • **Smaller** • **Lighter** • **Tighter**
• **More Uniform** • **Lower *Service* Cost**

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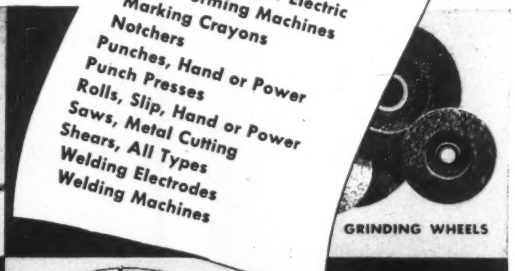
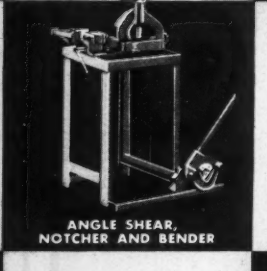
Shears, All Types
Welding Electrodes
Welding Machines

CLAMPS

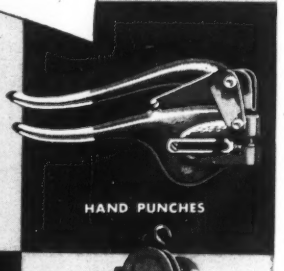
PORTABLE ELECTRIC SHEAR

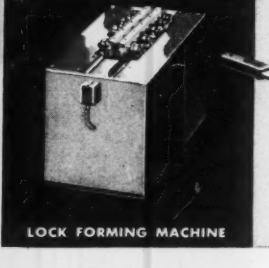

GRINDING WHEELS

METAL CUTTING BAND SAW

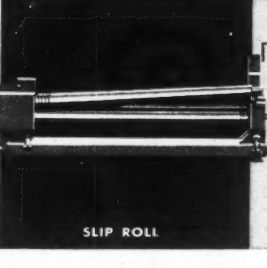

ANGLE SHEAR, NOTCHER AND BENDER

WELDING MACHINES


HAND PUNCHES


LOCK FORMING MACHINE

HAND BENDERS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UNITED STATES STEEL

Air-foil

AG-35 VOLUME CONTROLLER

NEW... REDUCES ADJUSTMENT TIME and LABOR 90%

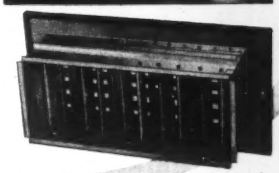
BALANCE SYSTEM WITHOUT REMOVING GRILLE

This means that plaster or paint is never damaged or smudged during balancing. Key-operator regulates air volume to hairline adjustment.

ONE-UNIT GRILLE and VOLUME CONTROLLER

COMBINE AG-35 with any AIRFOIL grille for complete one-unit handling.

PERFECT 4-WAY AIR CONTROL
Light weight—easy to handle—easy to install.



VOLUME CONTROL LOUVERS MOVE SIMULTANEOUSLY IN OPPOSITE DIRECTIONS—CLOSE TO ANY DEGREE DESIRED FROM FULL OPEN TO FULL CLOSED

Installers balance an air-conditioning system in *one-tenth the ordinary time* with amazing, new AIRFOIL AG-35.

There are no grilles to remove. *Workman's hands never touch grille or wall to leave dirty, expensive smudges.* Blades adjust faster—easier. Close more tightly.

Louvers do not close flat as in common styles using damper but *close at 45°.* This maintains a metering control down to the final moment of closure with a minimum disturbance of the air pattern.

Remember—there is *one unit to install—one unit to handle—one unit to purchase* when the air guide volume adjuster is combined with an AIRFOIL grille.

AIRFOIL Grilles are the most efficient ever designed. They are priced to enable you to use a superior product at lower cost. Get complete information at once.

FREE!

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air-conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ RUSH information on AG-35
- ☐ Send complete catalog.
- ☐ Send literature on above checked items.

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TACO has a proved record of helping

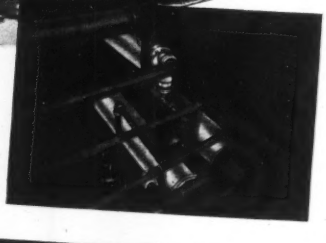
FACTORIES • OFFICE BUILDINGS • SCHOOLS • HOSPITALS • CHURCHES • STORES

SOLVE THEIR HEAT and HOT WATER PROBLEMS . . .

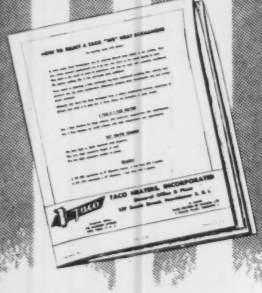
Provides hot water for wash fountains and showers for employees

Taco water heaters are supplying abundant low cost hot water in industrial plants throughout the United States. Our more than 30 years' experience in this field is a big help to those with hot water heating problems.

Heats entire building with heat formerly thrown away



A large industrial user of steam was dumping the condensate from their steam processing into a creek. Now, thanks to the 3 Taco heat exchangers on the right, they're reclaiming enough to heat the 220' x 560 building shown above. Taco products can perhaps do a similar service for you.



ENGINEERS . . . WRITE FOR

simplified selection chart for sizing Taco water heaters under any conditions such as steam pressure, temperature rise and pressure drop.

A TRAINED TACO SALES ENGINEER IS AVAILABLE WHENEVER YOU NEED HIS HELP

Better Heating-Better with Taco

TACO HEATERS, INCORPORATED

137 SOUTH STREET • PROVIDENCE 3, R. I.

Standard is always first with the finest

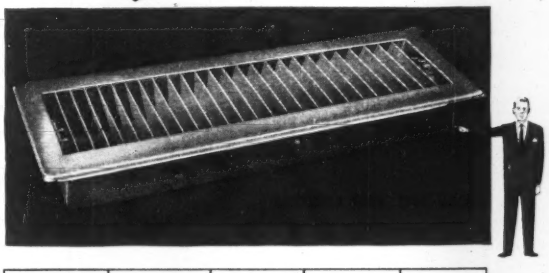
here it is...
the floor register everyone wants!

STANDARD'S NEW PERIMETER FLOOR REGISTER

with Standard's exclusive

Dialamatic Control

Standard's new, exclusive dialamatic control gives you POSITIVE HEAT CONTROL. The set screw arrangement means easy balancing, trouble-free operation!



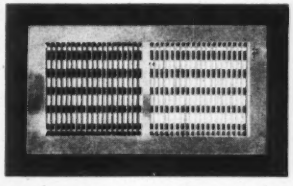
SPECIFICATIONS

The blades of model PH-142 are fabricated of 16 gauge steel, the blades are set in a fixed-fan angle degree for even deflection. The Frame is of one piece, 18 gauge steel construction. The Louvre box fabricated of 16 gauge steel. Packed one to a box, and 20 to a master carton. Comes handsomely finished in gleaming, durable metallic-lustre finish.

Duct opening	Overall of Louvre Box	Overall of Face	Open Area	Depth of Box
2¼" x 14"	2⅛" x 13¾"	3¾" x 15⅜"	80%	2⅛"

THE NEW, IMPROVED *multiple valve* REGISTER

Has Horizontal Multiple Valve Louvres, and 3/16" turned down edge for flush sidewall installation. The attached sponge rubber gaskets are an *extra* feature that prevents escape of air and chipping of wall surface. The Louvres are adjustable so that the flow of air may be directed either downward, straight forward, upward, or to complete shut-off.



MODEL NO. 331

Metallic Finish standard finish on this style

MEMBER NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION INDOOR COMFORT

write now!

No cost or obligation to you

Gentlemen: Please send me your new pocket catalogue at no cost to me.

NAME_____

ADDRESS_____ CITY_____ ZONE_____ STATE_____

COMPANY NAME

Standard Stamping and Perforating Co.

3151 West 49th Place—Chicago 32, Illinois

famed for buying only the best

S. S. PIERCE CO.

buys SPANG® CW STEEL PIPE

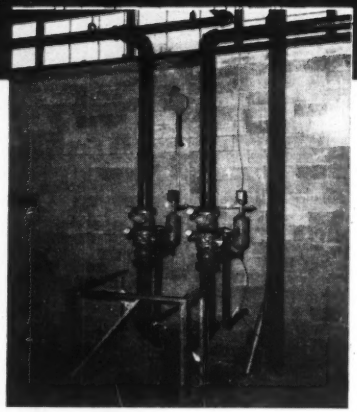
From all over the world S. S. Pierce Company imports the very finest of foods to please America's most discriminating buyers. So, naturally, S. S. Pierce has a quality-minded management—a management well aware that the best product is *always cheaper in the long run.*

In their new, big warehouse at Newton, Mass., for instance, S. S. Pierce selected materials with extra care . . . used Spang CW Steel Pipe extensively.

There's a good reason why Spang pipe has such acceptance with careful owners, contractors, builders—*from steel shelp to finished pipe it's a quality-controlled pipe.* Each piece starts with steels selected for very special characteristics . . . continues with the strictest metallurgical control during forming . . . concludes with final inspection and reinspection.

Which explains why Spang Steel Pipe has just the right temper for easy cutting, easy forming, easy threading . . . features that speed installation and reduce installation costs.

Don't just order pipe . . . order the *better* pipe from your Spang distributor.



Owner: S. S. Pierce Company, Boston, Mass.
General Contractor: W. H. Porter Company, Inc., Watertown, Mass.
Sprinkler Contractor: Viking Automatic Sprinkler Company, Inc., Boston, Mass.
Pipe Fabricator: Atlantic Pipe & Supply Company, Boston, Mass.

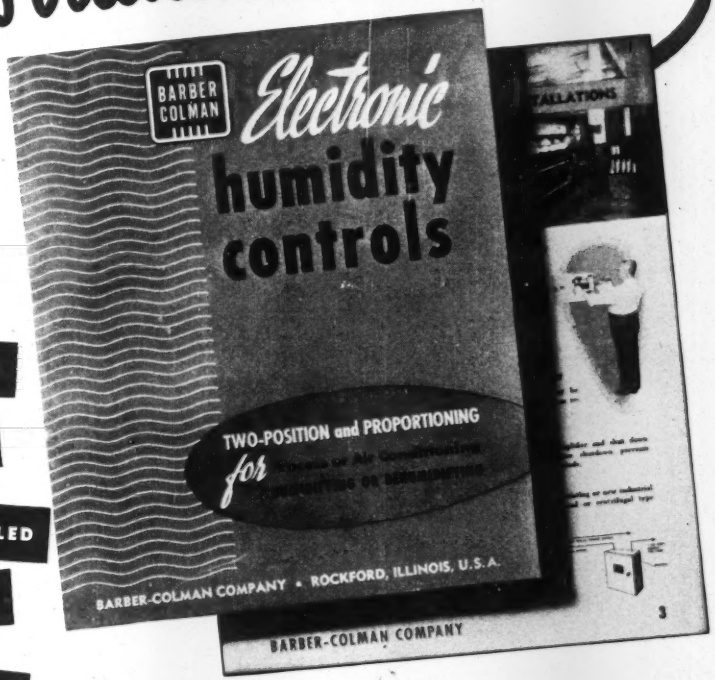
SPANG

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

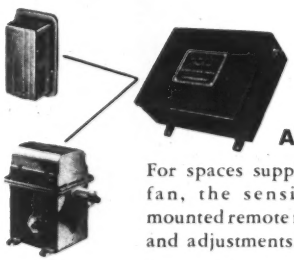
General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

here's valuable data...



- SUPER-SENSITIVE
- INSTANT RESPONSE
- RUGGED PLUG-IN ELEMENT
- EASILY INSTALLED
- ADJUSTABLE DIFFERENTIAL
- POSITIVE STABILITY
- SIMPLE ADJUSTMENTS

TWO-POSITION OR PROPORTIONING HUMIDIFYING OR DEHUMIDIFYING FOR *PROCESS* OR *COMFORT* CONTROL

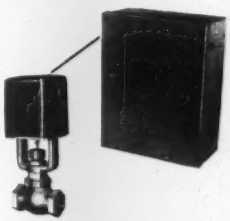


REMOTE ELEMENT APPLICATIONS

For spaces supplied by a central fan, the sensing element is mounted remote from the amplifier and adjustments.

ASPIRATING CONTROL

For use in those areas not completely air conditioned, the sensing element is mounted in a fan-fed sampling chamber.



Send for your copy of Catalog F-5173 today.

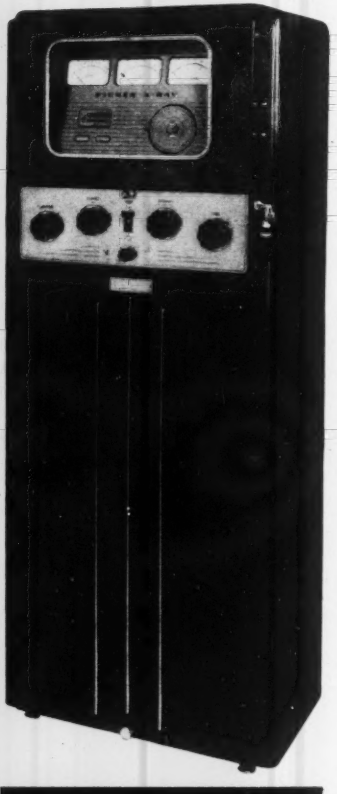
BARBER COLMAN

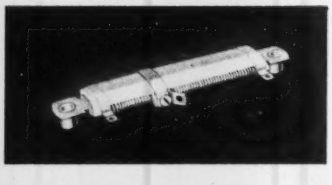
BARBER-COLMAN COMPANY

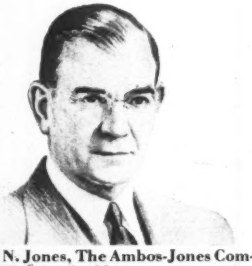
1228 ROCK ST., ROCKFORD, ILLINOIS

Picker X-Ray Corporation

"For accurate duplication of X-ray densities their resistors must be stable"







says O. N. Jones, The Ambos-Jones Company, Cleveland, Ohio, representative for Ward Leonard Electric Company

Duplicating densities of precise radiographs over prolonged periods demands exacting control of milliamperage through the X-ray tube. This means filament temperature must be accurately set.

That is why the absolute balance of thermal characteristics of Ward Leonard resistors is of utmost importance to the Picker X-Ray Corporation.

The only way to be sure that all resistor components will react the same to changes in temperature is to balance their thermal characteristics. In this way, there is no loosening, no failure, due to unbalance. Heat affects all parts the same way, which, in turn, means longer life, *stable performance.*

This stability in the presence of thermal shock is one of the major reasons the Picker X-Ray Corporation uses Ward Leonard STRIPOHM resistors in their V-12, 200 milliampere, 100 PKV X-ray controls.

The performance of VITROHM wirewound resistors, rheostats, and other electric controls under the severest operating conditions is proof of their complete dependability.

For correct, accurate current control, specify Ward Leonard VITROHM Resistors.

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Atlanta 5, Georgia	C. B. Rogers and Associates
Baltimore 18, Md.	Durling Electric Co.
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Hartford 6, Conn.	Ward Leonard Electric Co.
Houston 1, Texas	Brance-Krachy Co., Inc.
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New Orleans 13, La.	Electron Engineering Co.
Philadelphia 2, Pa.	Ward Leonard Electric Co.
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Roanoke, Virginia	Lynn H. Morris
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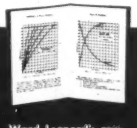
WARD LEONARD ELECTRIC COMPANY

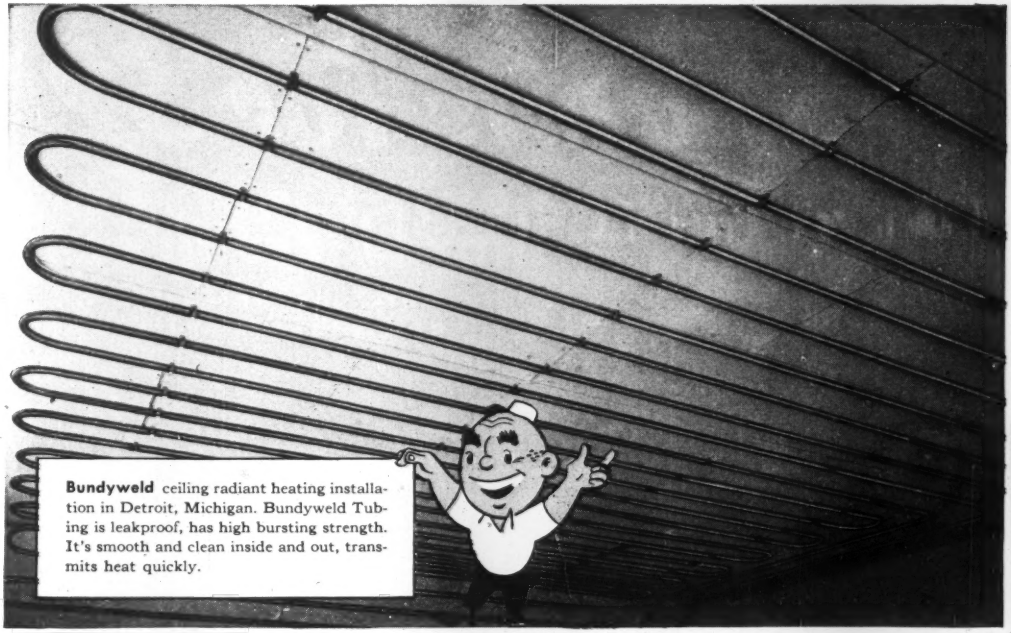
MOUNT VERNON, NEW YORK

RHEOSTATS · RELAYS · MOTOR CONTROLS · CHROMASTER

Result-Engineered Controls Since 1892

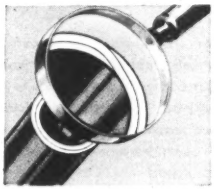


Ward Leonard's complete engineering textbook, "Handbook of Power Resistors," $3. per copy.



Bundyweld ceiling radiant heating installation in Detroit, Michigan. Bundyweld Tubing is leakproof, has high bursting strength. It's smooth and clean inside and out, transmits heat quickly.

A new, big source of business for you in Bundyweld ceiling radiant heating



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip. It's steel, copper-coated inside and out. It gives finest radiant heating performance, with savings up to 50% on material costs and installation time.

Standard 20′ or 24′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Install Bundyweld ceiling radiant heating and you'll profit by today's fastest-growing, most advanced heating method.

Thousands of home owners living with it will hear of nothing else. They're sold on its unique comfort, convenience, economy, freedom from dirt.

Thousands who read Bundy's ads in *Better Homes & Gardens* and *American Home* send in coupons for literature, write in for names of builders and contractors handling Bundyweld ceiling radiant heating. Many of these people are ready prospects for you.

Take advantage of this ready-made, rapidly expanding market. Move ahead of competition in your area. Send coupon for details on Bundyweld ceiling radiant heating and Bundyweld Tubing.

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

SEND FOR FREE LITERATURE!

Bundyweld ceiling radiant heating

Radiant Heating Division, Dept. HP-752
Bundy Tubing Company, Detroit 14, Michigan

- ☐ Send me free 20-page nontechnical brochure explaining Bundyweld ceiling radiant heating clearly and fully.
- ☐ Send me Bundy technical radiant heating pamphlet.

Name_____ Title_____

Company_____

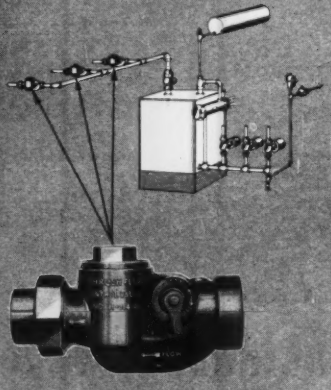
Address_____

City_____ Zone____ State_____

New Units for '52

HELP YOU PROVIDE BETTER HOT WATER HEAT

more conveniently and economically



HORIZONTAL
Thrush Flow Control Valve

Ideal for zoning modern homes. Give more headroom in low basements, save pipe. Simplify installation. Three sizes —1", 1¼", 1½" (with unions). ⅛" tapping for venting. Handy lever for raising seat disc to drain system or for gravity circulation.

NEW NO. 46
SAFETY
Relief Valve
A.S.M.E. APPROVED

A water relief valve designed to serve double duty of relieving not only water but steam if critically high temperatures occur in a hot water heating system. Conforms to A.S.M.E. code. ¾" inlet, 1" outlet.

3 NEW SIZES
Thrush Water Circulators

Low volume horizontal units for small heating plants. ¾", 1", and 1¼" sizes.

AN INCREASING number of smaller hot water heating systems are now being installed. The low water content of these systems requires small, low capacity circulators if "volume hum" is to be avoided. These new competitively priced small units enable you to do a better job at lower cost. Powered with ⅙ horsepower motors, with the same mechanical construction of the larger Thrush Circulators, and built-in lubrication, they will run quietly and smoothly for years. For information on the complete Thrush Flow Control System and other time-saving, money-saving hot water heating specialties, see your wholesaler or write Dept. E-6.

H. A. THRUSH & COMPANY
PERU • INDIANA

THRUSH

FORCED CIRCULATING FLOW CONTROL HOT WATER HEAT

THE REMOTAIRE
by AMERICAN-Standard

Ideal for new construction or modernization of hotels, motels, office buildings, hospitals, schools, apartments, and residences. Permits individual weather control for each room.

● **THE REMOTAIRE** is designed for summer cooling and winter heating for multi-room installations. Individual control of each unit allows the occupant to choose the room temperature that suits him best without affecting adjoining spaces.

Chilled or heated water is supplied to the Remotaire through a simple piping system from a remotely located central water chiller and heating plant. Designed for location under windows, the Remotaire can be free standing or recessed into wall 4 inches.

The Remotaire is provided with an arrangement for introducing ventilation air through a wall aperture. However, ventilation air may be supplied by several other methods if desired.

Installation of the Remotaire is easy and simple. For descriptive literature on this new remote type room air conditioner, including dimensions and ratings, write for Form 298.

Design provides low cost installation . . . efficient performance . . . and minimum maintenance

1. . . . four standard control packages are available.

2. . . . coil is designed for either right or left hand connections and can be easily reversed in the field if necessary.

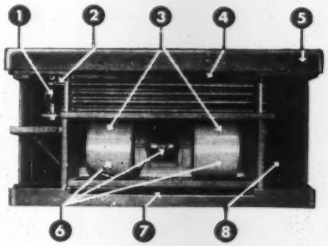
3. . . . exceptionally quiet with low speed fans and acoustically-treated air passages.

4. . . . coil shield over the top of the coil prevents foreign matter from falling into coil. Should liquid be spilled in air grille, the coil shield will safely carry liquid into drain so it will not injure unit or room floor nor interfere with operation of the Remotaire.

5. . . . rugged cabinet construction of sturdy, reinforced, furniture steel—plus a reinforced air grille—adds to permanence and long-lasting beauty of unit.

6. . . . fans and motor on single mounting plate permit easy removal if necessary.

7. . . . room ventilation can be adjusted —either manually or can be automatically operated—with the fresh air damper located in each unit.



8. . . . spacious end compartments with removable end panels provide ease of installation and allow more than 90° horizontal wrench swing.

American Radiator & Standard Sanitary Corporation, Dept. HP-62, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING-COOLING

Serving home and industry

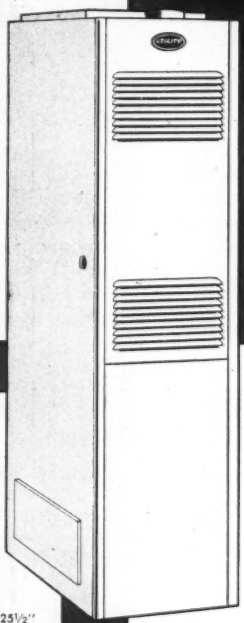
AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

UTILITY'S NEW 70FA

Dy-Rekt Drive Blower*

Sy-Lent Heat Exchanger*

*Registered



Sensational Low Price

Zero Clearance

UTILITY'S NEW "70FA" IS EASIEST TO SELL BECAUSE OF THESE FIVE REVOLUTIONARY NEW FEATURES:

1. New Dy-Rekt Drive Blower* is quietest yet—because of exclusive integrated, direct-drive assembly.
2. Newly-engineered Sy-Lent Heat Exchanger* practically eliminates noise as the furnace heats and cools.
3. Approved for Zero Clearance—can safely be installed flush with combustible material. No outside insulation needed.
4. Easiest to install—can be spotted in only 14" x 25½" floor space—in closets, alcoves, etc. Completely self-contained.
5. The Utility Model "70FA" 70,000 BTU Forced Air Furnace is fully approved under latest AGA requirements.

Utility Appliance Corp., **Dept. C-652** **[70-FA]**
4851 South Alameda St., Los Angeles 58, Calif.
Please send me FREE further information on the complete Utility line.

Name _____

Address _____

City _____ ( ) State _____

UTILITY now brings you a new high-performance furnace with unbelievable profit opportunities: The Utility "70FA"—a *full* 70,000 BTU forced air furnace at an amazingly low price we believe no other maker can match. The new Utility "70FA" 70,000 BTU Forced Air Furnace provides big-furnace luxury heating at a sensationally low price. It is also ideal for economical zone heating of larger homes. And it practically sells itself at its highly competitive price—so push the new Utility "70FA" and watch the profits roll in!

Your sales territory may be open—mail coupon today!

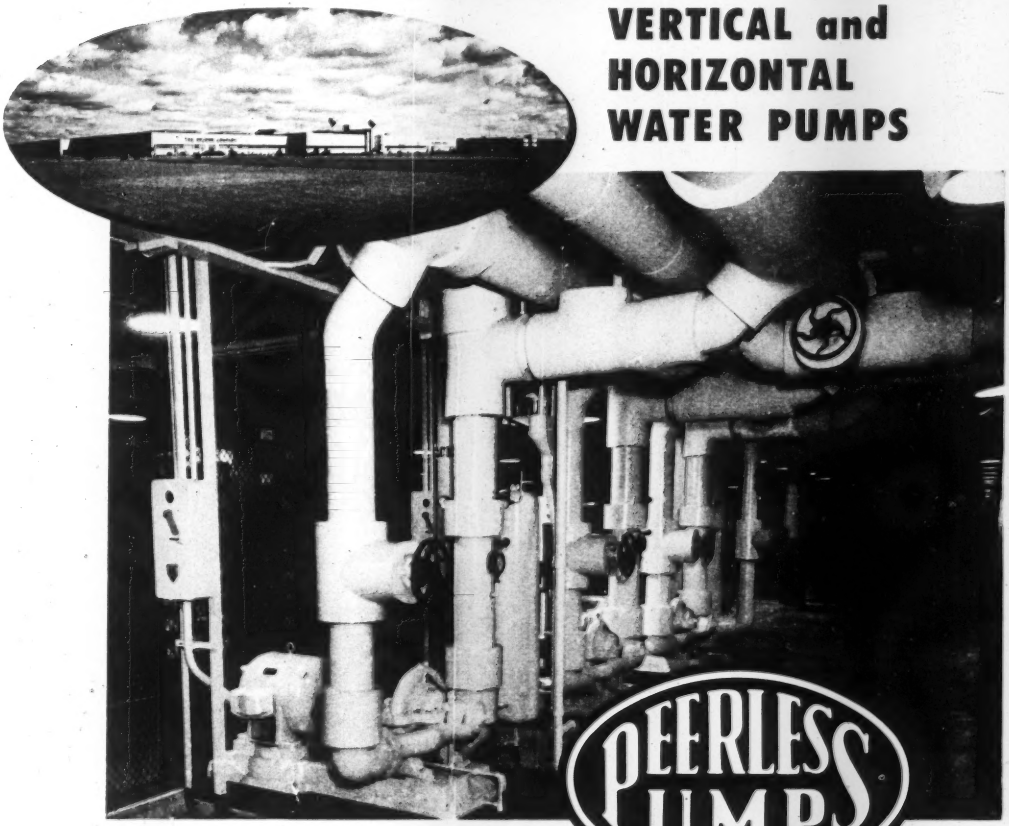
DELIVERIES NOW!

UTILITY TRADE MARK — Guaranteed Heating Performance

UTILITY APPLIANCE CORP. 4851 South Alameda Street, Los Angeles 58, Calif.

MANUFACTURERS OF AIR COOLERS, GAFFERS & SATTLER AND OCCIDENTAL AUTOMATIC GAS RANGES

2,800,000 CFM Air Conditioning System at The Upjohn Company uses PEERLESS VERTICAL and HORIZONTAL WATER PUMPS



PEERLESS PUMPS SUPPLY AND CIRCULATE ALL WATER TO SYSTEM FOR BOTH HEATING AND COOLING

In one of the country's largest air-conditioning systems, Peerless vertical pumps supply all the well water necessary for 2,800,000 CFM system in The Upjohn Company's new pharmaceutical plant near Kalamazoo, Michigan. In addition, all hot and cold water circulated within the plant for the huge air-conditioning system is pumped by Peerless Type A general purpose horizontal centrifugal pumps. A 100% Peerless raw water supply and circulating pumping system for air-conditioning, such as was selected by The Upjohn Company and their engineers and builders, The Austin Company, provides an efficient and dependable water pumping system for industrial and commercial structures. Write today for information and helpful bulletins that explain the application of both vertical and horizontal Peerless pumps to your water supply and handling requirements.

ON THE JOB!

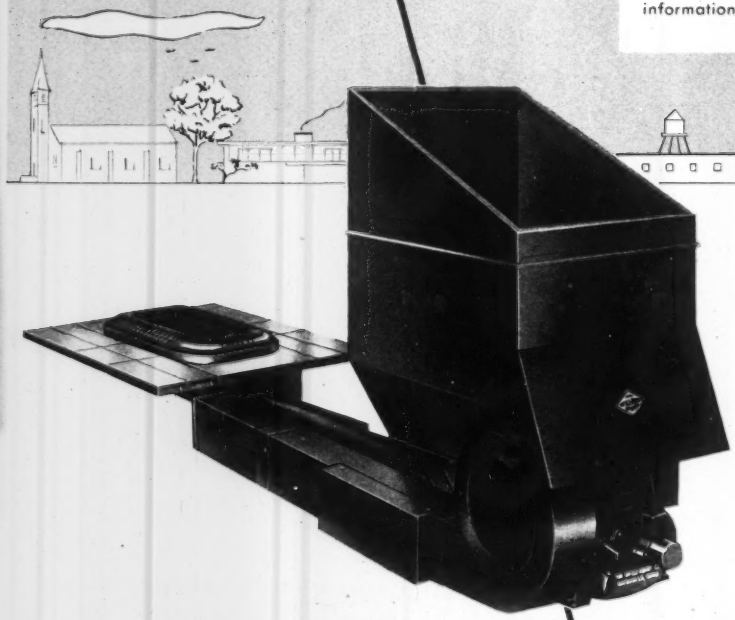
Inset Photo: Exterior of The Upjohn Company's new pharmaceutical plant near Kalamazoo, Michigan. Total refrigeration load for air-conditioning systems is 4,000 tons. Raw water is supplied at 54°F from deep wells by Peerless vertical turbine pumps.

Large Photo: One of several banks of 3 Peerless Type A pumps which deliver water to refrigeration compressors, as well as to roof sprays and cooling coils. Others handle circulation to hot water converters for heating in winter time. Peerless has furnished a total of 52 pumps in The Upjohn Company's plant.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Address inquiries to Factories at:
Los Angeles 31, Calif. and Indianapolis 8, Ind.
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.

Will-Burt Stokers open new horizons to DEALER PROFITS

If your stoker sales are not what they should be . . . if some of your profits go down the drain in excessive service calls, better see about Will-Burt. You'll find Will-Burt stokers sell because the quality is known — and proven. Outstanding features like the exclusive air control, patented safety shear pin and rugged over-all construction help you close a sale faster and easier. Will-Burt's complete range of sizes in both domestic and commercial models give you a wide market in any area where bituminous coal is burned. Bin feed models are available in addition to the hopper feed model shown. Investigate these new horizons in dealer profit today. Write, wire or phone for additional information.



Write on your letterhead for the Will-Burt stoker data book with engineering facts, dimension and installation drawings, suggested specification sheets, etc. Valuable!

OTHER WILL-BURT HEATING PRODUCTS

Gas and oil conversion burners

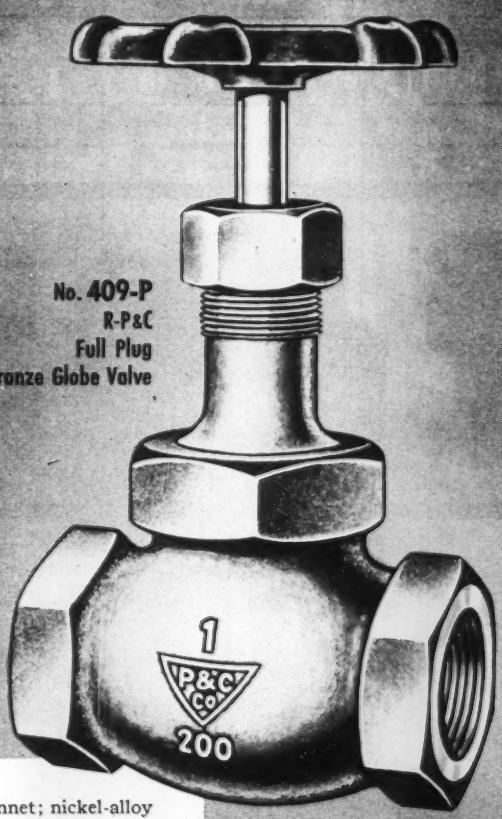
Residential hot-water heating boilers

WILL-BURT

THE WILL-BURT COMPANY

DEPARTMENT H ORRVILLE, OHIO

an **ACCO** product



No. 409-P
R-P&C
Full Plug
Bronze Globe Valve

● High test bronze body and bonnet; nickel-alloy disc and seat ring; high tensile, high torque rolled bronze stem—plus large, deep stuffing box easily repacked under pressure—these are the features which make R-P&C Bronze semi-plug and full-plug Globe and Angle Valves outwear ordinary valves. They're fine for frequent or continuous throttling of steam, gas, oil, water. This type valve can be furnished in 200, 300 and 350 lb. pressures.

See your R-P&C distributor for information on the complete line of R-P&C valves or write nearest district office.

R-P&C valves

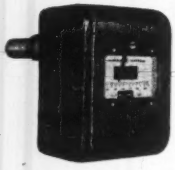
ACCO

TRADE MARK

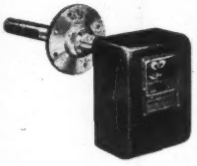
R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

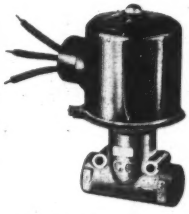
L-27 Electric Low Water Cut-Off



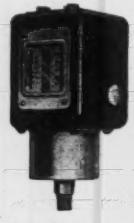
L-32 Immersion Thermostat



L-34 Combination Fan and Limit Control



K-24 Push Button Reset Magnetic Valve



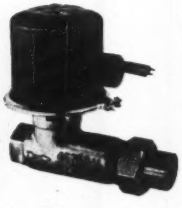
L-58 Steam Pressure Control

for better

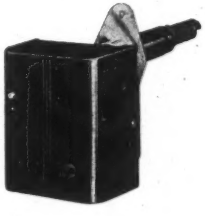
AUTOMATIC CONTROL

better check

GENERAL CONTROLS



K-10 Magnetic Lever Valve

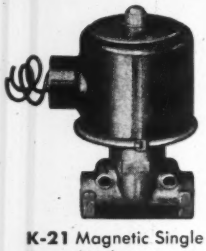


R-99 Oil Burner Stack Control

5 B Interval, On-Off Time Switch

G-2 Hydramotor Valve

T-70 Room Thermostat



K-21 Magnetic Single Seated Valve

When it comes to automatic control of heat, the leaders everywhere are discovering that there is a better answer to their problems of control at General Controls. So if you have a product or process... where control... automatic control... is a vital factor in performance or comfort... better check General Controls *today*.

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cleveland 15, Columbus 15, Dallas 2, Denver 4, Detroit 21, El Paso, Glendale 1, Houston 6, Indianapolis 4, Kansas City 2, Milwaukee 3, Minneapolis 2, Newark 6, New Orleans, New York 17, Omaha 2, Philadelphia 23, Pittsburgh 22, Salt Lake City, St. Louis 3, San Francisco 7, Seattle 1, Tulsa 6, Washington 6, D.C.
DISTRIBUTORS IN PRINCIPAL CITIES

GENERAL CONTROLS

801 ALLEN AVENUE GLENDALE 1, CALIFORNIA

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

GENERAL ELECTRIC

Announces

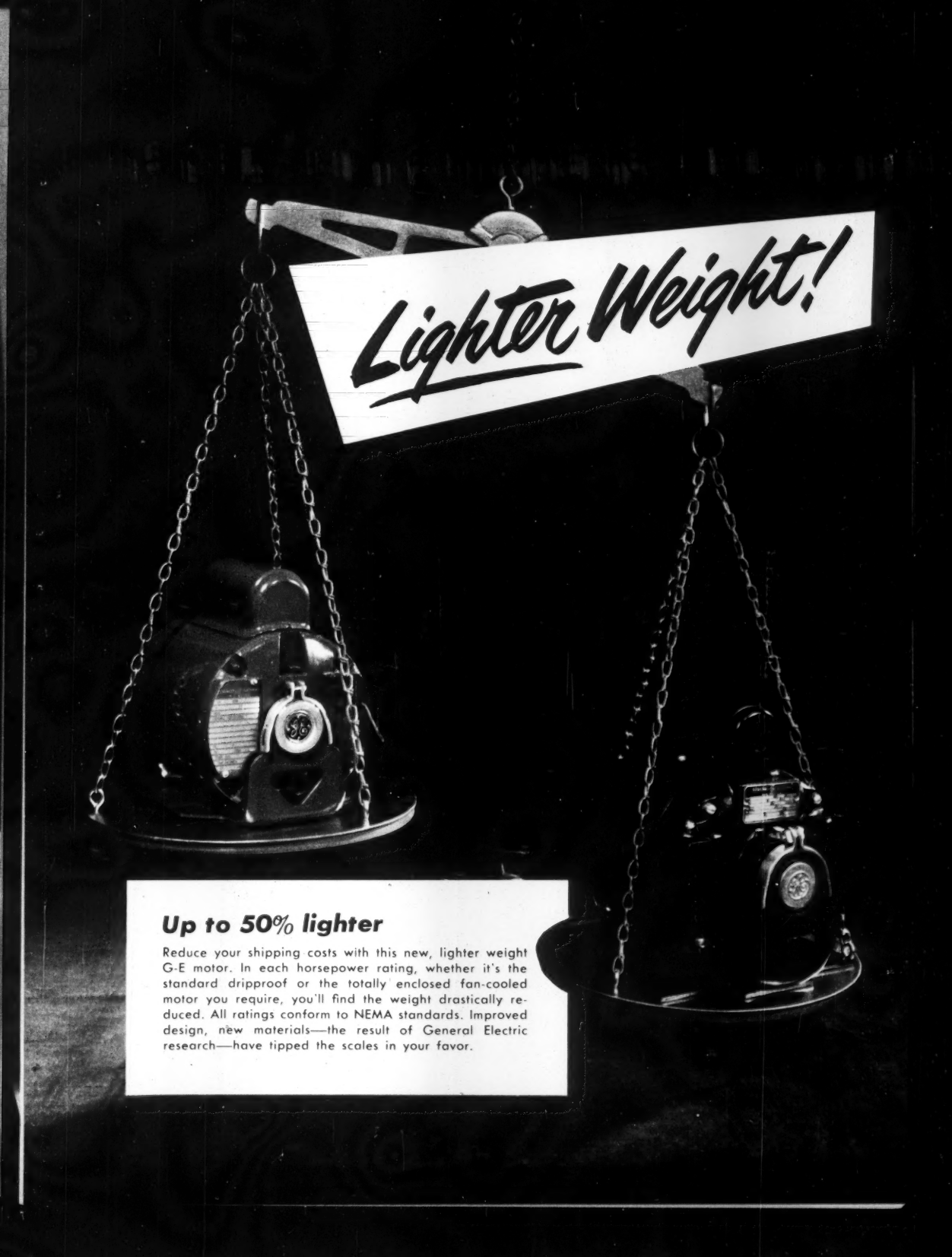
A COMPLETELY NEW FRACTIONAL HORSEPOWER MOTOR

Modern in Appearance...

AND...

Compare the old and the new

The new Form G General Electric f-hp motor requires less space—less space on driven machines—less space in storage and shipping. An entirely new ventilating system and more compact design, combined with strong but lighter metals, reduces the over-all dimensions. Throughout the line these motors are smaller, easier to mount.



Up to 50% lighter

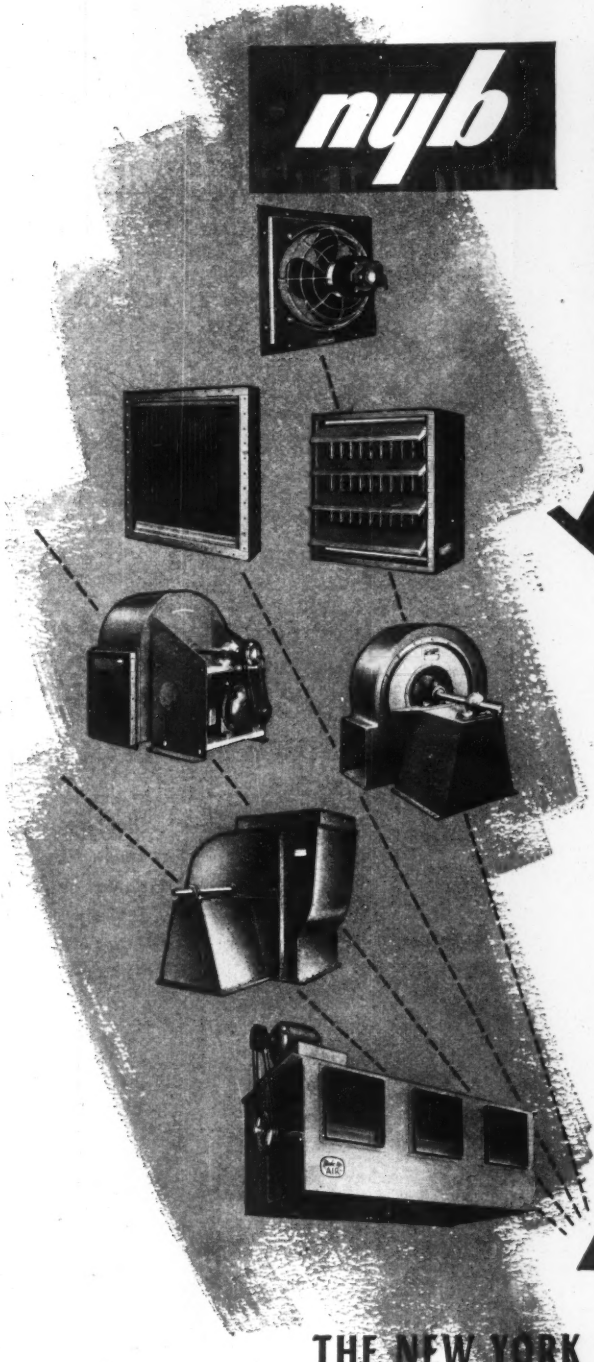
Reduce your shipping costs with this new, lighter weight G-E motor. In each horsepower rating, whether it's the standard dripproof or the totally enclosed fan-cooled motor you require, you'll find the weight drastically reduced. All ratings conform to NEMA standards. Improved design, new materials—the result of General Electric research—have tipped the scales in your favor.

All-angle operation

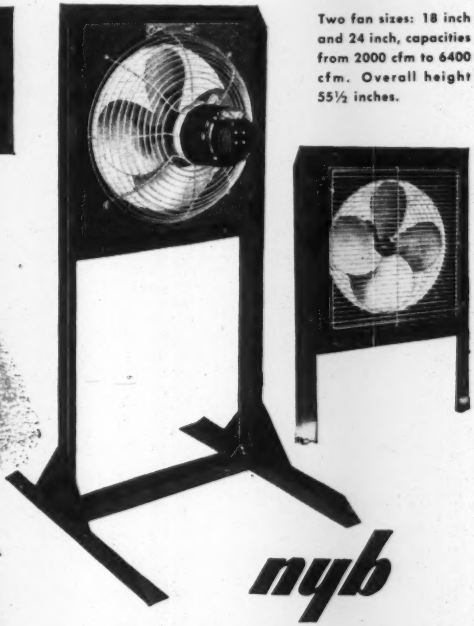
Mount the sleeve-bearing motor in any position. Turn it in its cradle as required—the new lubricating and ventilating systems assure you of long life with little maintenance. These features, combined with an insulating system using a newly developed Nylon material will often enable you to apply the standard sleeve-bearing motor in place of the more expensive specials. *Ask the nearest G-E office for bulletin GEA-5567 or write Section 700-112, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

700-112



nyb



Two fan sizes: 18 inch and 24 inch, capacities from 2000 cfm to 6400 cfm. Overall height 55½ inches.

nyb

PEDESTAL FAN

(Industrial Type)

Available for Prompt Shipment From Stock

Place this versatile fan in the most effective spot to deliver a gentle breeze or a brisk wind for a variety of uses. Safety guards front and rear with totally enclosed motors to meet State Industrial Safety Code Requirements. Bolted construction simplifies shipment, assembly and storage.

Write for Bulletins

FANS • BLOWERS • UNIT HEATERS • MAKE-UP AIR UNITS • HEAVY DUTY HEAT SURFACE

nyb

SEE OUR CATALOG IN SWEET'S

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA

TUTTLE and BAILEY

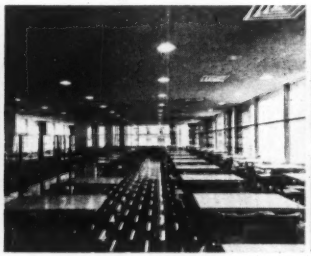
Type HPD high pressure diffuser units

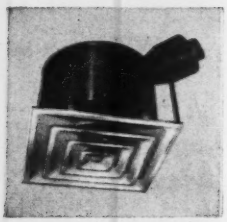
INSTALLED IN *Lever*

A DRAMATIC tower of glass, steel, and light, Lever House is acknowledged as an outstanding contribution to the development of modern office living. Planned throughout to provide ideal conditions for the work and relaxation of the 1200 employees of world-famous Lever Brothers Company and its four divisions, the 21-story structure is a tribute to those responsible for its conception and construction.

Contributing to the comfort, cleanliness, and efficiency of Lever House is the unique high pressure air conditioning system that delivers fresh, filtered, right-temperatured air in interior as well as perimeter zones.

This high pressure system resulted in elimination of a costly penthouse on the roof, elimination of return air ductwork on each floor, and a 50% reduction in the space normally required between furred ceiling and floor above.





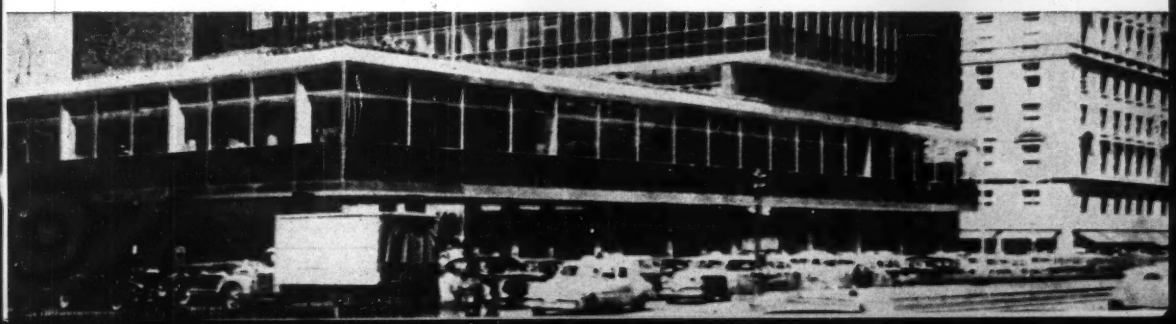
Tuttle & Bailey Type HPD High Pressure Supply Air Units selected for installation throughout Lever House were specially designed to handle the branch duct velocity of 3500 FPM. Supply air entering the housing from the branch duct passes through an airfoil type high pressure damper into an expansion silencer chamber where pressure is reduced from a branch duct pressure of 4" to 0.4" water gauge. A circular jet induces room air into the unit where it mixes with the primary air stream, and then discharges through the diffuser face.

Other Tuttle & Bailey equipment installed includes Type D square return air units designed to match supply diffusers . . . Type AL Aeroline return inlets . . . and, in the lobby, a special combination supply and return linear unit.

From preliminary stage to job completion, Tuttle & Bailey engineers worked closely with the engineering and architectural staffs. To be closely associated with so important a development as the high pressure air conditioning installation in Lever House is a unique experience for any manufacturer of air distribution equipment. Only through such experience in the field — coupled with a continuing program of laboratory research — is leadership maintained.

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT



88 YEARS OF EXPERIENCE
IN MALLEABLE FITTINGS

MIF

There is no substitute for experience, and in M.I.F.'s long history of making only the finest malleable fittings, emphasis on quality has been uppermost. The MIF diamond trademark on any pipe fitting is your guarantee of unfailing quality and satisfaction.

MALLEABLE IRON FITTINGS CO.
BRANFORD, CONNECTICUT

"SKIL Drills and Drivers beat all others in production and durability!"

—says **T. C. NORMAN,** general manager,
MASON AWNING & MFG. CO., Dallas, Texas

"For ten years, we've found our SKIL Drills and Drivers outperform all others. They're far superior in design and construction!" Such high praise of SKIL quality comes from T. C. Norman, general manager of this 26-year-old manufacturing firm. The Mason Awning and Manufacturing Company uses their 25 SKIL Drills and Drivers in all phases of production and installation of metal awnings.

This is typical of the strong preference for SKIL tools whenever comparison is made. SKIL users learn quickly to rely on the *extra* quality, power and dependability associated with SKIL portable tools.

SKIL Drill Model 47

¼" drill. Compact, heavy duty. Capacity in hardwood: 0" to ½"; in steel: 0" to ¼". Standard speed: 1800 r.p.m. Faster and slower speeds available. Overall length: 7¼". Weight: 3½ lbs.

See your Distributor for complete information or call your nearest SKILSAW factory branch.

SKIL
PORTABLE TOOLS
SKIL Products are made only by SKILSAW, INC.
5033 Elston Ave., Chicago 30, Illinois
SKILSAW Factory Branches in 34 principal cities
In Canada: Skiltools, Ltd.
3601 Dundas Street West, Toronto 9, Ontario

John Hearn uses a Model 47 SKIL Drill in a final assembly operation. "More power and better balance make SKIL Drills easier to handle with faster operation," he says.

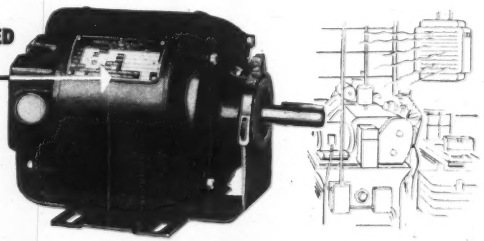
Efficiency Dropped with the Temperature in the 90's

Cold hands put a "frostbite" on production efficiency in the 1890's. Today, efficient unit heaters force billows of warm air to every corner of even the largest plants. The temperature stays up . . . so does worker efficiency.

Mechanized plant heating is just one of the factors, selected from a multitude of industrial applications for motor power, which has contributed to the present era of mass production methods.

Ever since its founding in 1890, Emerson-Electric has specialized in building dependable motors for equipment used in industry, on the farm, in business, and in the home. There is a complete line of Emerson-Electric motors in ratings from 1/20 to 5 horsepower. Your inquiry is invited. THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.

MODERN INDUSTRY IS POWERED WITH ELECTRIC MOTORS



Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M138-A Capacitor-Start
- ☐ M138-B Split-Phase
- ☐ M138-C Integral
- ☐ M138-D Fan-Duty
- ☐ M138-E Oil-Burner
- ☐ M138-F Jet Pump
- ☐ M138-G Blower

EMERSON ELECTRIC
MOTORS • FANS — APPLIANCES

LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

Free Engineering Data

on BOILER FEED and CONDENSATE RETURN SYSTEMS

Information That is Often Hard to Find When You Need it . . . Get it Now and Keep it Handy

This information belongs in your files It will be of inestimable help to you when planning or specifying systems or components to do specific jobs most efficiently. Included are complete engineering data and specifications on:

ENGINEERING BULLETINS

"A Discussion of Deaerator Design Principles," covering design intent, basic requirements, and other considerations. *Engineering Bulletin 570.*

Engineering Notes for Storage Hot Water Heaters. How to determine the proper heater for specific applications. *Engineering Bulletin No. 911.*

ENGINEERED CONDENSATION DRAINAGE AND AUTOMATIC BOILER FEED SYSTEMS:

Standard boiler return systems—Pree-Heet Systems—Heat reclaim systems—Spray type deaerating systems—Zero oxygen deaerating systems. *Catalog 55-A.*

QUIK-TEMP HEATING SYSTEMS:

A method of continuous stream circulation and air removal that permits machines to heat almost instantly and keeps them hot with minimum effect from load change. Increases production potential 10% or more. *Bulletin 548-B*

MAGNETROL BOILER WATER LEVEL CONTROLS:

Transmits changes in water level to the switching mechanism by magnetic action. Simple, fool-proof, positive. May be used for fuel cut-off and alarm, cut-off only or alarm only. Models for all steam pressures up to 600 pounds. *Catalog Section 111.*

CONDENSATE RETURN SYSTEMS:

Low-cost prefabricated type and heavy duty knockdown type. Featuring Master-Bilt maintenance-free pumps—Chromasoid receivers, warranted for 10 years against internal corrosion failure—Magnetrol controls. *Bulletin 655.*

CHROMASOID LINED HOT WATER STORAGE HEATERS:

Featuring Chromasoid lined tanks guaranteed against corrosion failure from any kind of water for 10 years. *Bulletin 910.*

"DRAINTROL" FOR CONTROLLED CONDENSATION DRAINAGE:

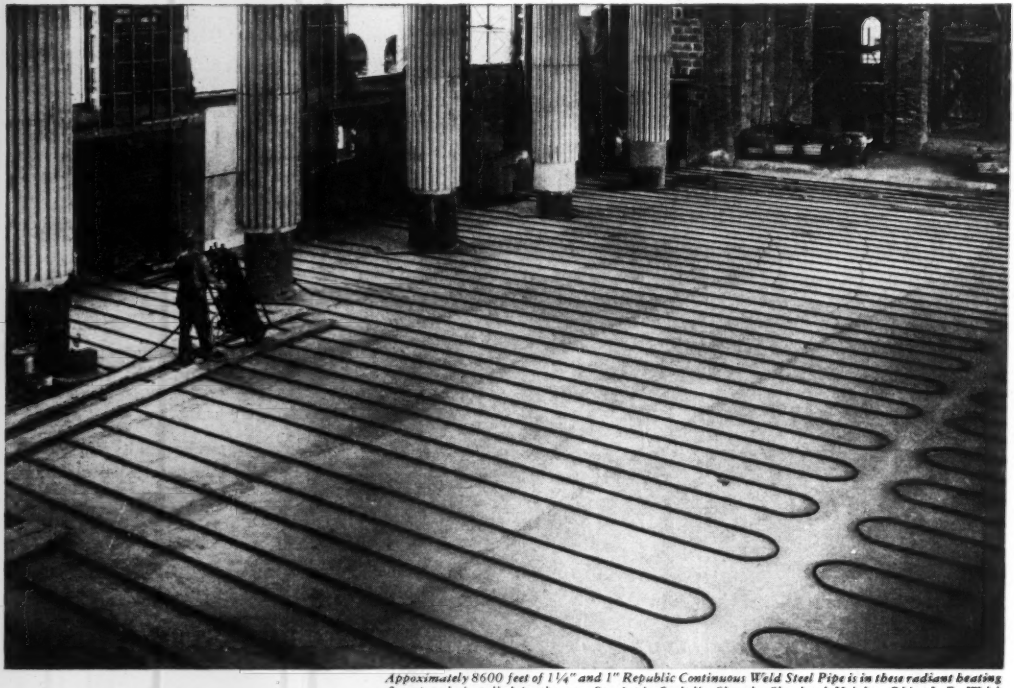
Replaces steam traps. Enables higher surface temperatures by continuous condensation drainage and air removal. *Bulletin 642.*

FRED H. SCHAUB ENGINEERING CO.
2116 SO. MARSHALL BLVD.
CHICAGO 23, ILLINOIS

FRED H. SCHAUB ENGINEERING CO.
2116 S. Marshall Blvd., Chicago 23, Ill.
Please send me the bulletins checked below:

- ☐ Catalog 55-A
- ☐ Bulletin 548-B
- ☐ Catalog Section 111
- ☐ Engineering Bulletin 570
- ☐ Bulletin 655
- ☐ Bulletin 910
- ☐ Bulletin 642
- ☐ Engineering Bulletin 911

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____



Appoximately 8600 feet of 1¼" and 1" Republic Continuous Weld Steel Pipe is in these radiant heating floor panels installed in the new St. Ann's Catholic Church, Cleveland Heights, Ohio. J. F. Walsh Co., heating contractor; John T. Butler Co., general contractors; Walker and Weeks, architects.

Made to take the bending and coiling of Radiant Heating Panels

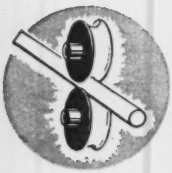
● Republic Steel Pipe is right for radiant heating. Made by Republic's own *improved* continuous weld process, it is highly ductile and easy to fabricate . . . especially suited to close coiling and bending.

For many years, steel pipe has been standard for all types of closed heating systems. Its trouble-free service has proved you need nothing more costly for closed radiant heating systems. And, *today's* Republic Steel Pipe is even better than the pipe which served so well over the past twenty years.

It welds readily by all modern methods. Long lengths speed installation by reducing the number of joints required.

Yes, Republic Steel Pipe meets all requirements for radiant heating—including low first cost and long life. Your Republic Pipe Jobber will be glad to give you latest information on available sizes and current delivery schedules. See him, soon.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.



REPUBLIC CONTINUOUS WELD PIPE

Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths
Expansion co-efficient same as concrete and plaster

SOUTHERN HOSPITALITY by JUNG

Architects: Weiss & Silverstein
Consulting Engr.: Wall & Moses
Mech. Engr.: Mayer Godchaux

MODERN COMFORT by Marlo

Remote room air conditioning units offer complete flexibility of installation, individual room comfort control—with no ductwork needed.

Floor and ceiling units—compact, efficient—to serve any area with complete summer-winter functions.

Marlo Evaporative Condensers and Cooling Towers can be installed *indoors* (don't hog the skyline) . . . and they save up to 95% of normal cooling water demand.

The Greater Jung Hotel of New Orleans, largest hotel in the South, is now bigger and better equipped —offers its guests *the best* in service . . . comforts . . . conveniences.

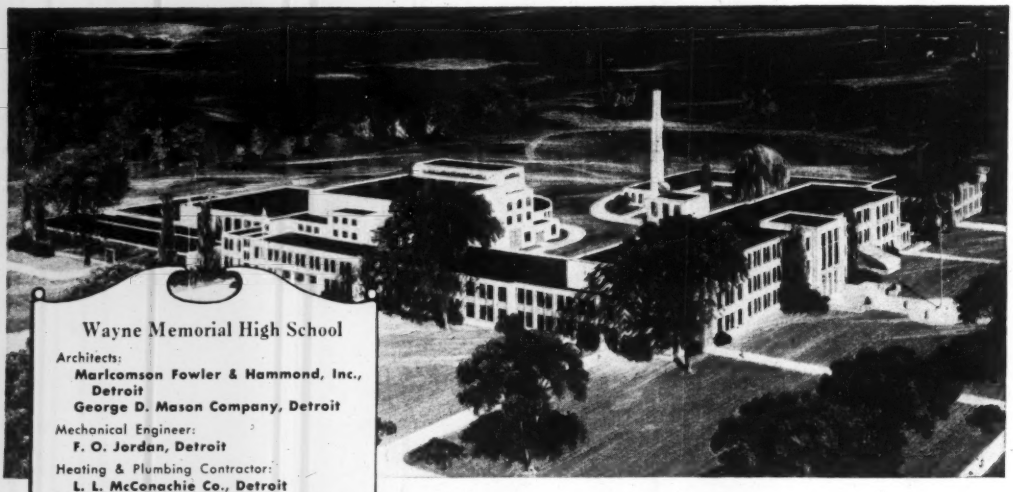
That's why modern Marlo Comfort Equipment was selected for its new meeting rooms — and guest rooms — in the recently completed addition.

• These Marlo units are designed to serve your air conditioning needs . . . better! Write for information on the complete Marlo line.

Marlo
MANUFACTURERS OF

COIL CO. • 6135 Manchester Rd. • St. Louis 10, Mo.

COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS
AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS



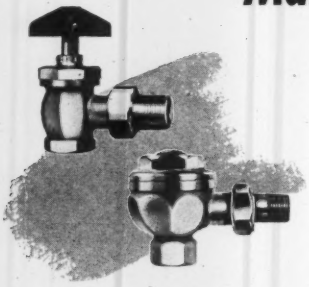
Wayne Memorial High School

Architects:
Marlcomson Fowler & Hammond, Inc., Detroit
George D. Mason Company, Detroit

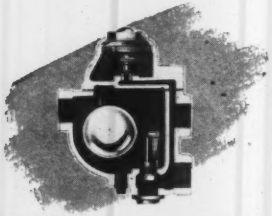
Mechanical Engineer:
F. O. Jordan, Detroit

Heating & Plumbing Contractor:
L. L. McConachie Co., Detroit

Marsh Valves and Traps Throughout



Marsh Packless Valves and Radiator Traps were chosen throughout for the Wayne Memorial High School. The most permanent packless valve construction is the Marsh metal-to-metal seal and the best team-mate for this better valve is the Marsh radiator trap.



Marsh float and thermostatic traps like this were used in the Wayne High School.

Pride of its community is this modern 3½ million dollar high school at Wayne, Michigan, near Detroit. It is a worthy addition to the growing list of model school buildings that are rising to the call of the tremendously increased number of young folks who are going in for more and more education.

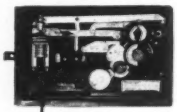
Such buildings are planned and erected to become a lasting part of community activities; so it is significant that a large number of Marsh valves and traps were used in the well-engineered system which heats the laboratories, library, cafeteria, gymnasium, offices and classrooms.

But high tribute though it is, the selection of Marsh equipment here is simply one more example of the preference accorded Marsh heating specialties by foremost heating engineers and contractors in every section of America.

For your next job consider the equipment that is first choice of the most critical heating men. Write for the Marsh heating specialties catalog, 76-H, covering Marsh valves, traps, venting devices and the dollar-saving Marsh Tri-Trol regulator.

MARSH HEATING EQUIPMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
Dept. T, Skokie, Ill.

BIG FUEL SAVING WHEN HEAT REGULATION IS IN STEP WITH THE WEATHER:—

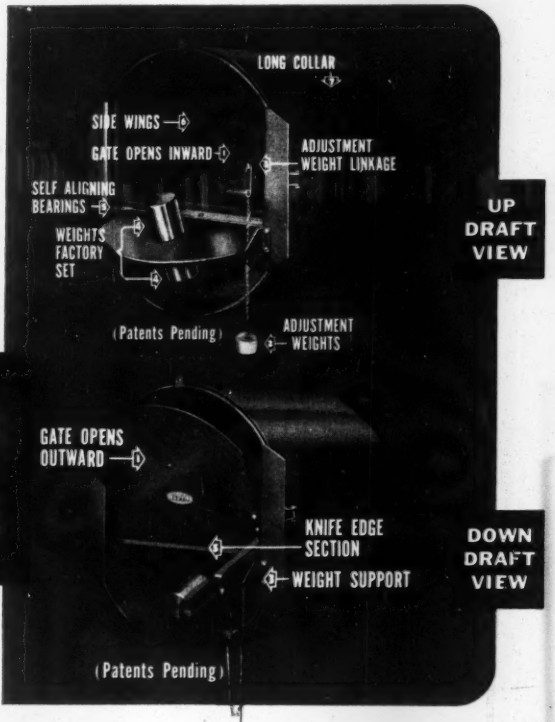


Marsh Tri-Trol is the simple, low-cost, easily installed heat regulator for multiple occupancy buildings from smallest to largest. Ask for bulletin showing how it gives ideal heating comfort at lowest cost by controlling heating in accordance with outside temperature.

MARSH *Heating Specialties* **SINCE 1865**

Now ... a *field* BAROMETRIC DRAFT CONTROL FOR COMMERCIAL & INDUSTRIAL

GAS FIRED HEATING PLANTS



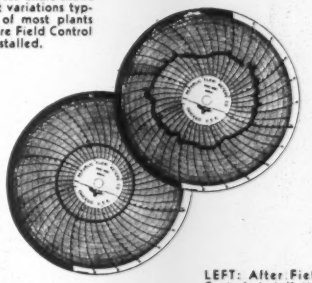
(Not yet available in domestic sizes)

The Field "M-G" Double Acting Draft Control brings greater efficiency, greater economy to gas fired heating plants through extremely accurate control of drafts. The double-acting gate opens inward to regulate up-drafts, and outward to relieve internal or down-draft pressures as small as a few thousands of an inch. This newest Field Draft Control provides for gas-fired heating plants the same accuracy, sensitivity and dependability that have made Field Draft Controls first in the coal and oil-fired fields. Write today for detailed specifications.

FIELD CONTROL DIVISION
of H. D. Conkey & Company, MENDOTA, ILLINOIS

In case of prolonged down draft or blocked flue, an optional auxiliary switch can be mounted on the control and wired to shut off the burner, thus providing protection against the escape of carbon monoxide into the building.

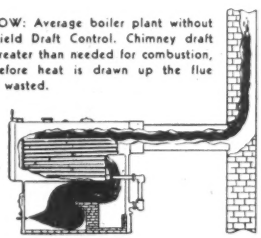
RIGHT: Chart shows draft variations typical of most plants before Field Control is installed.



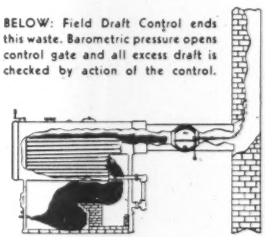
LEFT: After Field Control installation the breeching draft is held constant.

Why a Field Draft Control:

BELOW: Average boiler plant without a Field Draft Control. Chimney draft is greater than needed for combustion, therefore heat is drawn up the flue and wasted.



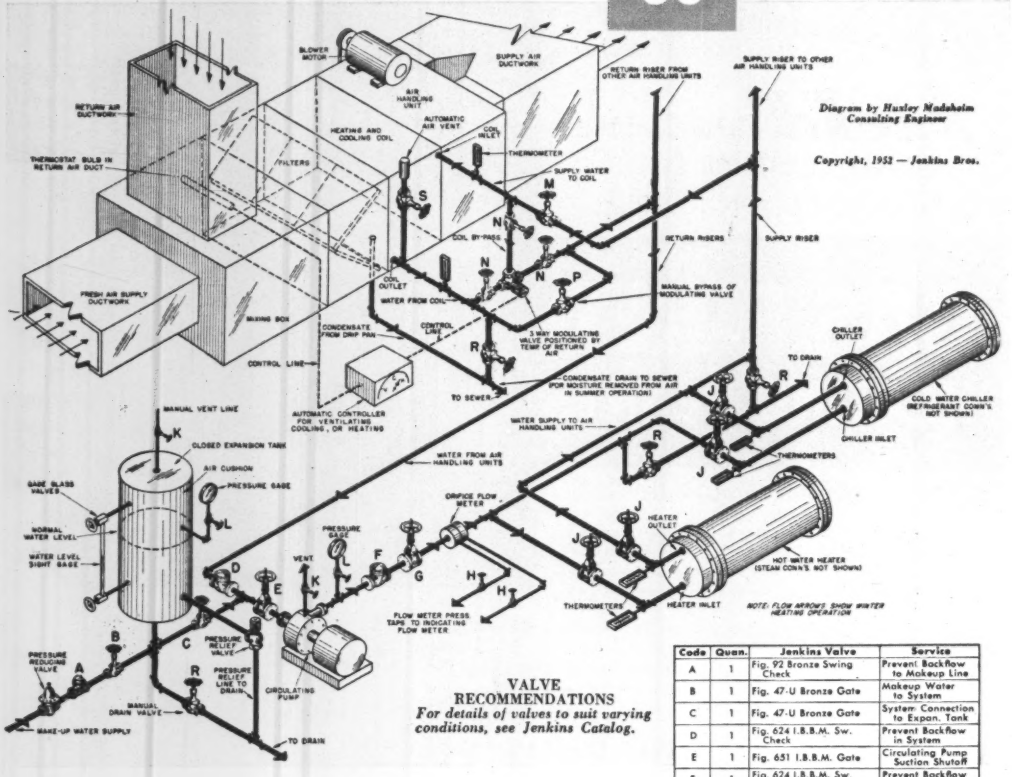
BELOW: Field Draft Control ends this waste. Barometric pressure opens control gate and all excess draft is checked by action of the control.



CONTROLLED DRAFT BY *field* BAROMETRIC CONTROLS

JENKINS PRACTICAL PIPING LAYOUTS

60



VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	1	Fig. 92 Bronze Swing Check	Prevent Backflow to Makeup Line
B	1	Fig. 47-U Bronze Gate	Makeup Water to System
C	1	Fig. 47-U Bronze Gate	System Connection to Expan. Tank
D	1	Fig. 624 I.B.B.M. Sw. Check	Prevent Backflow in System
E	1	Fig. 651 I.B.B.M. Gate	Circulating Pump Suction Shutoff
F	1	Fig. 624 I.B.B.M. Sw. Check	Prevent Backflow in System
G	1	Fig. 142 I.B.B.M. Globe	Regulate System Flow
H	2	Fig. 743-G Bronze Needle	Orifice Flowmeter Tap Connections
J	4	Fig. 651 I.B.B.M. Gate	Chiller and Heater Shutoffs
K	2	Fig. 743-G Bronze Needle	Vent Controls
L	2	Fig. 743-G Bronze Needle	Pressure Gage Controls
M	1	Fig. 106-A Bronze Globe	Flow Control to Individual Coils
N	3	Fig. 47-U Bronze Gate	Modulating Valve Shutoff
P	1	Fig. 106-A Bronze Globe	Modulating Valve Manual Bypass
R	4	Fig. 106-A Bronze Globe	Drain Valves
S	1	Fig. 106-A Bronze Globe	Vent Shutoff

How to plan a

SINGLE COIL ALL-YEAR AIR CONDITIONING SYSTEM

In the system illustrated — one of the best of the many types for institution, industrial, and domestic installations — the water in a closed continuous circuit is pumped through either the chiller or heater and then to the air handling units.

All air supplied to conditioned spaces is filtered to remove dust, pollen, or other particles. Also, a positive means is provided to introduce fresh air which is properly mixed with the returned air before re-use.

A thermostat, located in the return air duct, regulates the position of the three-way modulating valve on the individual coil which maintains the desired temperature in the conditioned space. Since total flow to each unit is constant, any change at one unit does not affect the flow at other units.

The three-way valve meters the necessary amount of water to the coil, and at the same time bypasses the balance of the constant flow around the coil.

Consultation with piping engineers is recommended when planning any major piping installations.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from Jenkins complete line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

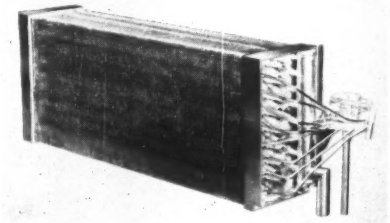
Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 60.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864

EQUIPMENT DEVELOPMENTS...

Copper Coil Lowsides for "Freon" or Water

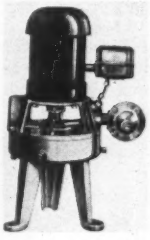
HPAC 1—Direct expansion lowsides with all-copper tube and fin coils — Hastings Air Conditioning Co., Hastings, Neb. Tubes are mechanically expanded against fin collars and then solder bonded. Sizes range from 1000 to



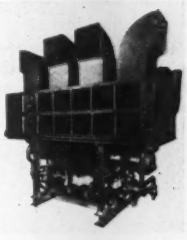
12,000 cfm and all units are complete. Steam or hot water coils are available for all models. Chilled or well water units from 600 to 12,000 cfm, featuring 6-row copper coils, also are available.

Deep Well Pump

HPAC 2—"Burks" deep well pump (H-V Series) which may be used in either horizontal or vertical position for depths to 130 ft — Decatur Pump Co., Decatur, Ill. Patented "Kam-Action" impeller-volute combinations are incorporated for increased capacity (up to 1500 gph), and all sizes, which are available through 1 hp, have heavy duty, long life motors, the manufacturer states. A special air vent is built into the pump for easier priming, serving to bleed off air and gas from the case. The pressure switch is designed to prevent the diaphragm from becoming clogged with sediment. There is a one piece solid stainless steel shaft and a solid bronze impeller.



Pump



Conditioner

Self-Contained Air Conditioner

HPAC 3—100 ton self contained air conditioner which is factory assembled and shipped as a complete unit — Airtemp Construction Corp., subsidiary of Chrysler Corp., 1600 Webster St., Dayton 1. The unit, which is ready for use after connection of the condenser cooling water lines, drain lines and electrical supply, was developed for commercial and industrial use and is adaptable for free blow applications or with duct work for central station use. Per ton of refrigerating capacity, the unit weighs 140 lb, and occupies 0.76 sq ft of floor space. The condensing section contains two radial compressors directly connected to a 100 hp motor, a water-cooled condenser, "Freon" piping and electrical controls. The air handling section includes four fans which circulate 35,000 cfm of air, 28 washable, high velocity filters, and four 4-row evaporator coils which have a face area of 73.6 sq ft. The unit is available with heating coils with a capacity up to 1,450,000 Btu per hr for winter conditioning.

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1952 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [6-52]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	19	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36									
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115
116	117	118	119	120	121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138							

Name _____ Title _____

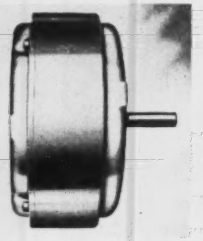
Company _____

Address _____

City _____ Zone _____ State _____

Motor

HPAC 4—"Wafer" motor designed with short overall length, and suited to applications requiring a totally enclosed, air cooled unit with a flat design — Reuland Electric Co., Alhambra, Calif. It is available in ratings of 1/20 through 5 hp, and in speeds of 450 to 3600 rpm, or polyphase. In ventilating and air moving installations where the motor itself is to be mounted within the piping or vent, the frame design permits mounting by means of "ears," by drilled and tapped holes in endbells, or by any other special means. Mounting can be with shaft up or down. When mounted in this way the fan can be connected directly to the motor's output shaft, eliminating pulleys, belts, brackets and fan shaft.



Motor

Insulation

Dual Temperature Pipe Insulation

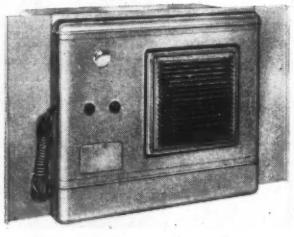
HPAC 5—Dual temperature "Fiberglas" pipe insulation for pipe lines operating at low temperatures or at alternate cycles of high and low temperatures — Owens-Corning Fiberglas Corp., Toledo 1. Made of fibrous glass bonded with a thermosetting binder, it is preformed in hemi-cylinders and segments that fit all standard pipe and tubing sizes. A vapor barrier composed of laminations of asphalted kraft paper and aluminum foil adhered to the insulation with a bituminous adhesive (as shown) provides condensation control on cold lines passing through warmer temperatures. Since little heat is gained by the insulated pipes, there is considerable saving in refrigeration cost, the manufacturer states. To seal the end lap joints between sections, a 4-in. strip of vapor barrier paper is supplied. These strips, with the jack flaps, are sealed with vapor barrier adhesives. The dual temperatures insulation may be used on pipe temperatures from sub-zero to 25 F. It is designed for indoor use, but if pipes run outdoors, a 35 lb roofing felt jacket should be used. Insulation on pipes more than 12 in. in diameter is furnished in three segments. The insulation cannot be used on valves and fittings.

Marine Type Humidity Conditioning Units

HPAC 6—"Kathabar" marine type humidity conditioning units in a new large capacity — Surface Combustion Corp., Toledo 1. The unit represents the largest capacity marine type dehumidifier ever built into one package, and provides this capacity with minimum space and dead weight requirements, the company states. Contracts to humidity condition 25 cargo ships of the C4S1A type with these specially designed units were recently placed with the manufacturer, and representatives from three major shipyards and the U. S. Maritime Administration have observed formal acceptance tests. Using sea water at 88 F for cooling the absorbent solution, the dehumidifier delivered 7000 cfm of air dried from 140 to 44 grains per lb, exceeding the specifications called for. Tests also showed freedom from carry-over of the absorbent solution in the leaving air stream.

Evaporative Air Cooler

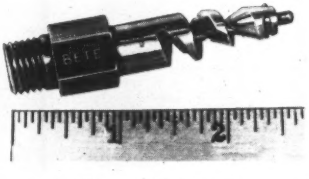
HPAC 7—Portable "Pour-in Sno-Breze" evaporative air cooler, direct drive blower Model B-1800-PI, especially adapted for window installation — Palmer Mfg. Corp., 2200 W. Filmore St., Phoenix. The vertical direct drive operates the blower and recirculating pump from the same motor. The unit is self-contained, with built-in pump and adjustable grille to send air in any desired



direction. It is 21 in. high, 24 in. wide, and 15 in. deep, and may be filled by hand or by an automatic float valve to maintain constant water level in the cooler reservoir. A trough type water distribution system delivers water to the aspen cooler filter pads. The cooler, which moves 1000 cfm of air, may be used for ventilation and cooling, or for circulating filtered air only, with the water switch off.

Fog Nozzles

HPAC 8—Series AA all-stainless steel fixed installation fog nozzles for industrial processing and fire protection — Bete Fog Nozzle Inc., 85 Pierce St., Greenfield, Mass.



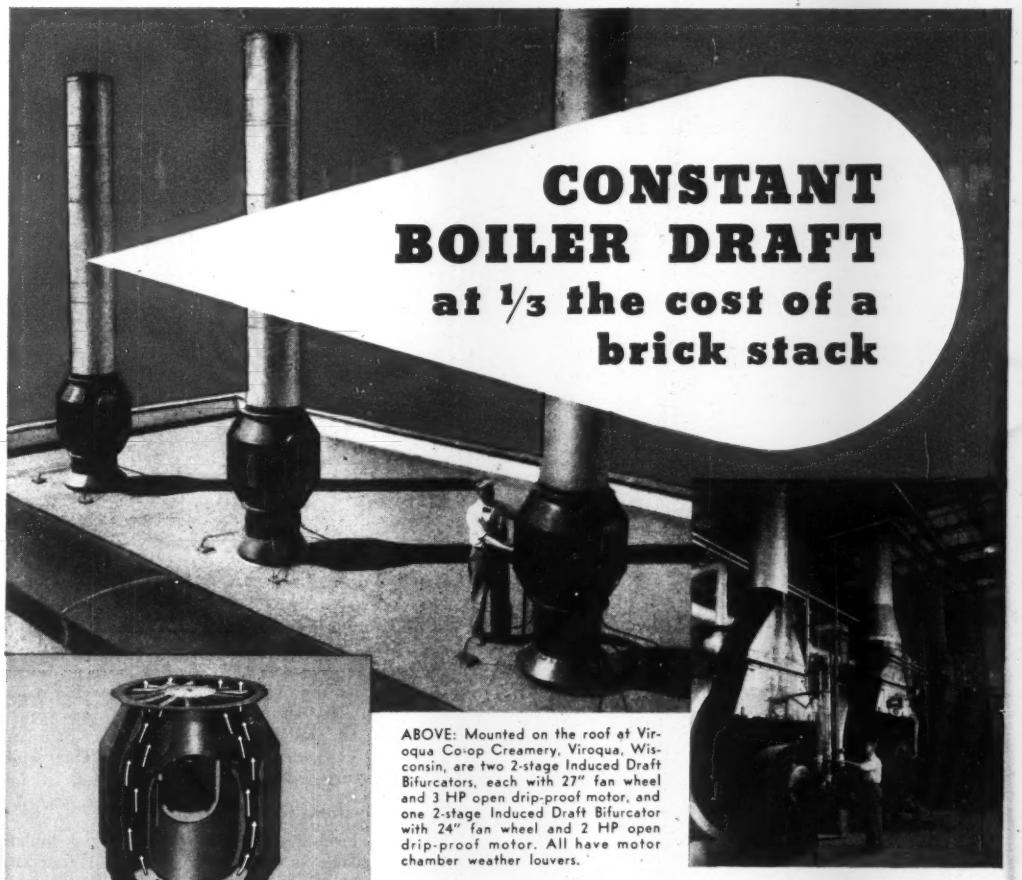
The nozzles are smaller and lighter than previously and are available in six models, three flow rates, and with a full or hollow cone fog pattern. A $^1/_4$ in. male pipe thread connection is standard.

Sight Flow Indicator

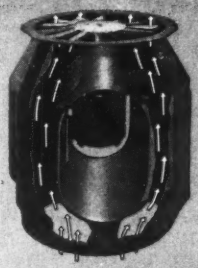
HPAC 9**—"Trin-Vue" indicators for checking flow of fluid in piping systems and for visual examination of the fluid in the line, incorporating two windows located on opposite sides, to permit maximum visibility — Trinity Equipment Corp., Roselle Park, N. J. They are fabricated of heavy wall forged tubing with lap joint stub ends welded into the side of the body, eliminating the weight of a casting. Design permits use of stock size tubing, use of steel flanges rather then flanges of special material, and a reduction in weight of the special material required. Windows are sealed in the unit by means of O ring gaskets and "Truarc" retaining rings, permitting a tight seal,

CONSTANT BOILER DRAFT

at 1/3 the cost of a brick stack



ABOVE: Mounted on the roof at Viroqua Co-op Creamery, Viroqua, Wisconsin, are two 2-stage Induced Draft Bifurcators, each with 27" fan wheel and 3 HP open drip-proof motor, and one 2-stage Induced Draft Bifurcator with 24" fan wheel and 2 HP open drip-proof motor. All have motor chamber weather louvers.



HOW BIFURCATOR FAN WORKS

The Induced Draft Bifurcator is a direct motor driven fan in a divided housing. The motor is in an isolated chamber around which the flue gases are by-passed. Thus the motor always remains cool, clean and easily accessible. Induced Draft Bifurcators are available with fan wheels from 12" through 36" in diameter, for high pressure boilers delivering up to 60,000 pounds of steam per hour and for low pressure boilers delivering up to 190,000 EDR.

If you have a difficult stack problem, read what Sylvan Dregne, manager of the Viroqua Co-op Creamery, says:

> "We have two 200 and one 125 HP oil-fired boilers. During our busy season, we use two boilers for about 15 hours a day, 7 days a week and the one boiler for about 5 hours more after the peak load is over. We installed the Bifurcator Fans in September, 1951, and we have used them since then without any service required. They have proved to be very satisfactory, and they maintain a constant draft regardless of weather conditions. We installed these fans for approximately 1/3 the cost of a suitable brick stack."

How much can YOU save by installing Induced Draft Bifurcator Fans? Ask your DeBothezat representative or write our factory for details.

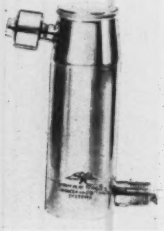
DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

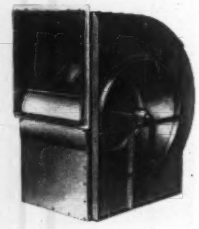
which is made tighter the greater the pressure or vacuum. There are no bolts to be adjusted, and pressure on the glass is equally distributed at all times, the manufacturer states. The indicators are available in all special materials, and are easily demountable, the manufacturer states.

Radiator Valve

HPAC 10—"Steamheat Master" valve designed for steam radiators, and to operate without noise or hissing — Radiator Valve Co. of America, 428 S. 52nd St., Philadelphia 43. It is applicable to oil, gas or coal fired systems. Weight is 4 oz., and finish is polished aluminum.



Valve



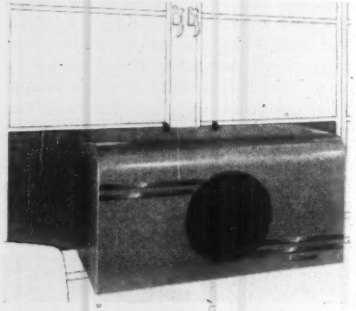
Fan

Centrifugal Fans

HPAC 11—New and expanded line of centrifugal fans designed to afford high efficiency, low rotational speeds, and low noise levels — Aladdin Heating Corp., 2222 San Pablo Ave., Oakland 12, Calif. The line includes backwardly inclined and forward curved fans in 22 sizes of from 12¼ to 98¼ in. wheel diameters. Each size is manufactured in single and double width, and in both class I and class II construction.

Room Air Conditioner for Steel Casement Windows

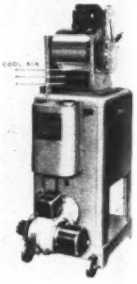
HPAC 12**—Room air conditioner which fits into steel casement windows, eliminating need for altering mullions and muntins — The Deering Air Conditioning Co., 5037 Beech St., Cincinnati 12. For installation, the



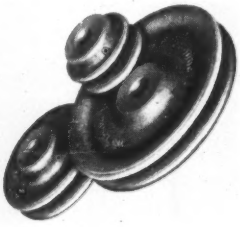
two lower panes of glass are removed, the unit is slid into the window, and the electric cord plugged in. For 1952, production will be limited to the ½ hp, 115 volt, and ¾ hp, 115 and 230 volt models.

Portable Furnace

HPAC 13—Dual purpose Model 189 portable furnace which furnishes heat in winter and circulates cool air in summer — Fageol Heat Machine Co., 5725 Mt. Elliott Ave., Detroit 11. The unit delivers 189,000 Btu per hr of heat. The heat is sprayed out at the floor level over an area of about 3000 sq ft. The model is so designed as to be easily converted to a cool air blower in summer. When the top blower mounting is changed, the machine delivers 1500 cfm of cool air.



Left: Furnace



Above: Sheaves

Molded V Belt Sheaves

HPAC 14**—V belt sheaves, molded from "Compolene" (fibrous material molded to close tolerances under high pressure), for light machinery drives — W. C. Products, Inc., 1748 Berkeley St., Santa Monica, Calif. The material possesses an extremely hard wearing surface which is unaffected by moisture, oil, temperature, etc., the manufacturer states. The sheaves are stocked in sizes from 2 to 6 in. OD, in gradations of ½ in. Bore sizes are ½, ⅝ and ¾ in., with or without keyways. Total width is $1\frac{7}{16}$ in.

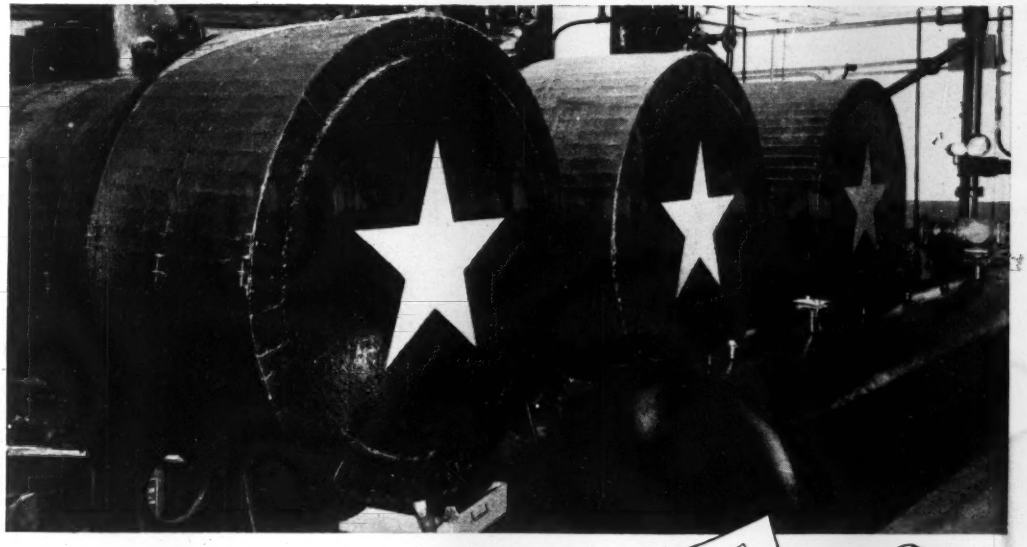
Feedwater Systems for Industrial Boilers

HPAC 15—Feedwater systems for industrial boilers, which are available as complete systems, or in four kits: make-up assembly, heater assembly, receiver assembly and complete pump assembly — York-Shipley, Inc., York 4, Pa. Each kit is available separately. The systems are manufactured for use with the company's "Steam-Pak" generators. Units automatically supply hot make-up water for boiler operation. The systems reclaim both high and low pressure condensate and are designed to maintain a constant uniform water temperature, eliminating need for using cold make-up water. Standard pump set assemblies are available for 100, 125, and 150 lb per sq in. pressure and for boilers from 15 to 300 hp. Receiver assembly capacity ranges from 30 to 450 gal. Heater assemblies are available in eight sizes from ½ to 2 in. capacity, and make-up assembly, in six sizes from ½ to 2 in.

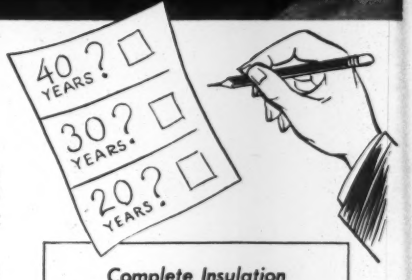
Small, Single Stage, Double Suction Pumps

HPAC 16—Class DMV (for medium heads) and DHV (for high heads) small, single stage, double suction pumps, which now incorporate double mechanical shaft seals with sealed, pre-lubricated ball bearings — Ingersoll Rand Co., Dept. CAM, 11 Broadway, New York 4. Built in 3,4,5 and 6 in. sizes, the pumps are designed for general hydraulic services at temperatures up to 200 F, capacities to 2100 gpm and pressures to 150 psi. Use of a double

(*Continued on page 206*)



Can you guess the age of this insulation?



A good insulation job never looks its age. The cork lagging on these brine coolers, for example, seems almost new. It is still dry, highly efficient, and shows no signs of deterioration. Yet this insulation was installed in 1912—40 years ago!

These tanks are part of the equipment at the Memphis Cold Storage Warehouse Company. In that warm, humid climate, 6″ of Armstrong's Cork Lagging has held temperatures of 12° below zero at remarkably low refrigerating costs. The lagging has proved its superior moisture resistance despite the wide temperature differential outside and inside the vessels. The only maintenance has been occasional inspection of the bands and periodic painting with asphalt paint.

It takes the right combination of sound engineering, top-quality materials, and expert application to give that kind of service. But when Armstrong's Corkboard, Lagging, or Cork Covering are used, records like this aren't unusual. Today, hundreds of cork installations across the country are performing efficiently after 20, 30, and even 40 years of service!

Low-temperature insulation is a long-term investment. That's why it pays to contact Armstrong whenever you're planning any insulation job. We offer a complete line of the finest insulating materials and the skilled workmen to apply them properly. You get an insulation job that gives years of economical, trouble-free service. For further information, just contact your near-by Armstrong office or write direct to Armstrong Cork Company, 4406 Concord St., Lancaster, Pa.

Complete Insulation Contract Service

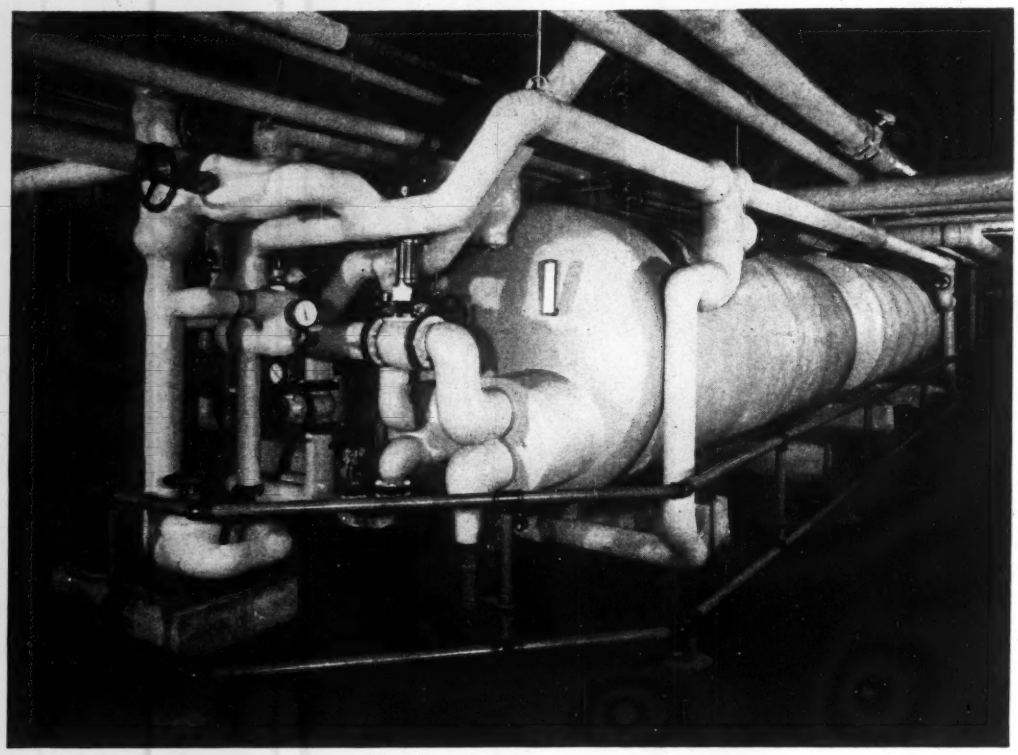
When you engage a contractor, you have a right to expect certain things that cannot be written into a proposal. These factors can largely determine whether or not the agreement will be entirely satisfactory. They include:

1. Financial responsibility — resources to complete the contract despite any unforeseen events.
2. Integrity — a reputation for quality work and for prompt settlement of any justified complaints.
3. Technical ability — experience, plus technical and research staff to complete the work in accordance with best practices.
4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.
5. Efficiency — ability to handle accurately things like accounting, tax provisions, insurance, and workmen's compensation.

You get all these with an Armstrong Contract

Armstrong's INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.



Hot water tanks and steam connections, Chicago Athletic Club, Chicago, Ill., with lifetime insulation of "Featherweight" 85% Magnesia. **Plumbing Contractor:** W. W. Watson Co. **Insulation Contractor:** Standard Asbestos Co. of Chicago

This insulation keeps them in hot water . . . **and they love it!**

ANOTHER BOOST FOR "Featherweight" 85% Magnesia

When a user is spending money to heat water, he wants it to stay hot *until he needs it*—and that's where "Featherweight" 85% Magnesia will do just that.

Take this installation, for example. "Featherweight" 85% Magnesia completely insulates those big tanks, and holds the heat so well that loss from radiation is at a minimum.

You can get and hold business with performance like that!

And this insulation is permanent . . . because "Featherweight" holds up—and will not deteriorate and lose its efficiency.

You don't have to *baby* "Featherweight", either—it's light, yet rugged. And it's easy to apply . . . fits snugly to contours, can be sawed or cut, and goes on quickly. You can get it in all forms, too—blocks for flat, curved, and irregular surfaces; in sections and sets of segments for standard pipe sizes.

In fact, you'll find the whole line of K&M Low Pressure Insulations, shown in the table at right, equips you to handle any insulation requirement. Write for further information regarding these insulations.

RANGES OF KEASBEY & MATTISON LOW PRESSURE INSULATIONS

INSULATION	50°F	100°F	200°F	300°F	400°F	500°F	600°F
DUPLEX							
AIR CELL							
FINE CORRUGATED AIR CELL							
SPECIAL FINE CORRUGATED AIR CELL							
SIMPLEX "SUPER SHRUNK"							
"FEATHERWEIGHT" 85% MAGNESIA							

K&M best in asbestos ®

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Comfort Air Washer

For Every Cooling Need—Year-After-Year

Show your customers how easy it is to

from HOT to COOL with COMFORT (Air Washers)

EXTRA

HERE IS A PROFIT FOR YOU... AND... THE RIGHT ANSWER FOR ECONOMICAL SUMMER COOLING FOR HOMES... INSTITUTIONS... BUSINESSES... IN YOUR TERRITORY.

4 Practical Sizes Built to deliver FULL-RATED CAPACITY of TRIPLE-WASHED, COOL, FILTERED, FRESH AIR per minute, all season long.

Model	CFM Capacity	Motor
35 AW	3500	½ h.p.
50 AW	5000	1 h.p.
75 AW	7500	2 h.p.
100 AW	10000	3 h.p.

SPRAY-WHEEL motors for all models. ⅓ h.p., single or three-phase.

EASY TO SHIP, HANDLE, AND INSTALL

All four sizes of Air Washers built in two sections, a blower and a filter section, quickly and easily joined.

Let US SHOW YOU HOW COMFORT AIR WASHER CAN MEAN EXTRA PROFIT FOR YOU

Here are "PLUS" Selling Points... the Exclusive Comfort-Engineered Features

- All incoming air washed of dust and dirt, filter pads remain unclogged... cooling efficiency stays high and uniform.
- Comfort Spray-Wheel provides continuous sheet of mist and heavy water over pad surfaces. No pumps, no spray nozzles . . . trouble-free.
- MORE PAD AREA (stairstepped in design) permits lower velocities, lower resistance and higher efficiency
- FIBERGLAS (Reg.) Pads throughout are FIRE PROOF —eliminate vegetable and fungi odors.
- Non-splash louvers eliminate back-splashing of water.
- Rust-proof construction, durable, attractive, hammer-enamel finish outside.
- Self-aligning graphite bronze pillow blocks, wool felt, packed deep to provide long, trouble-free Air Washer service.

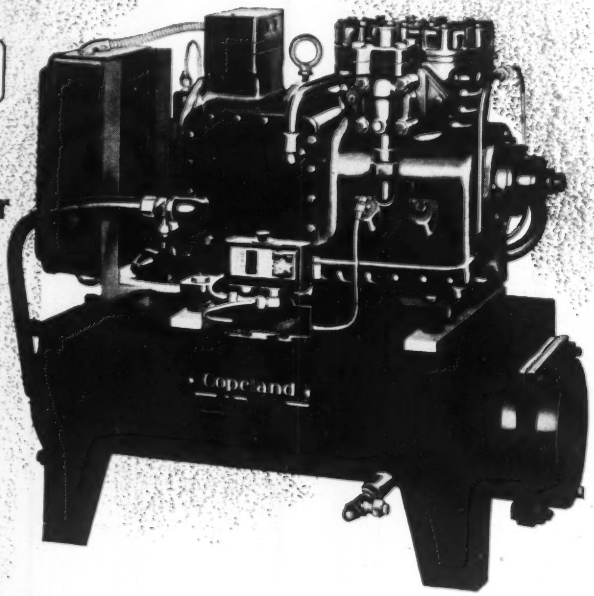
IT'S EASY TO SELL C-O-M-F-O-R-T

COMFORT PRODUCTS CORPORATION

2220 LAMESA • DALLAS, TEXAS

COPELAMETIC

THE *Accessible* HERMETIC



condensing units and motor-compressors for all air conditioning requirements

- ☑ COMPACT
- ☑ ECONOMICAL
- ☑ DEPENDABLE
- ☑ RUGGED
- ☑ QUIET

Copelametic is as modern as air conditioning itself. Its advanced design neatly combines the best qualities of open-type and welded-in units into one compact package. No belts, no seals, no manual oiling. It is fully accessible when the rare occasion arises.

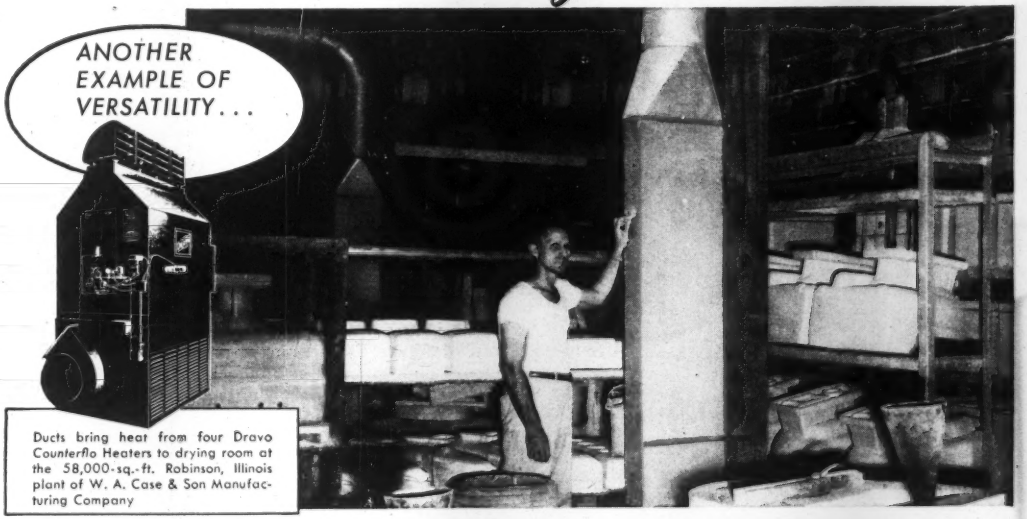
And the Copelametic is just one star performer in our dependable line. There is a rugged Copeland unit for every application in refrigeration and air conditioning. Sizes through 7½ H.P. Write today for complete data.

Copeland

DEPENDABLE *Electric* REFRIGERATION

COPELAND REFRIGERATION CORPORATION, SIDNEY, OHIO

W. A. Case doubles Production Capacity . . . with Dravo *Counterflo* Heaters



Ducts bring heat from four Dravo *Counterflo* Heaters to drying room at the 58,000-sq.-ft. Robinson, Illinois plant of W. A. Case & Son Manufacturing Company

1. PROCESS DRYING TIME DECREASED . . .

Four Dravo Heaters have decreased the drying time of vitreous china plumbing ware pottery castings and molds by 50%, permitting a second eight-hour working shift with existing facilities. The heaters operate 24 hours a day, seven days a week, maintaining an 85° to 90° F. temperature throughout the building; heater maintenance is at a minimum.

2. HARMFUL DUSTS FILTERED AND AIR RECIRCULATED . . .

Fresh outside air is mixed with filtered return air, providing greater fuel economy. Warm air is distributed through ductwork to avoid undue movement of powder used in mold dusting . . . an important health consideration for workers. Heaters are operated with gas but are equipped with conversion burners to use oil during gas curtailments.

DRAVO HEATERS OFFER YOU . . .

- **LOW INITIAL COST**—users report savings of 30% to 60% over standard "wet-type" systems.
- **EASY INSTALLATION**—no duct work required . . . only fuel, exhaust and electrical connections.
- **LOW OPERATING COST**—burn gas or oil . . . easily converted . . . direct-fired . . . minimum efficiency 80%.
- **LONG LIFE**—low maintenance—rugged construction . . . stainless steel combustion chamber eliminates refractory lining.
- **HEAT WHERE YOU NEED IT**—right in the working zone . . . roof heat losses reduced.
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I would like more information about Dravo *Counterflo* Heaters. Please send me Bulletin No. CD-523

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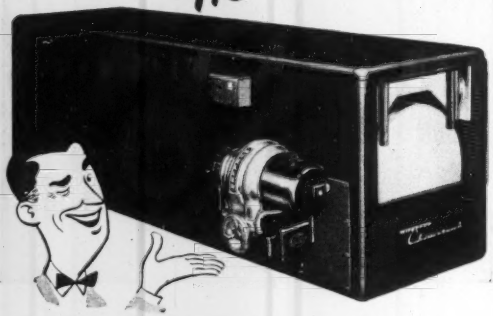

Low-Cost Oil Heat For all Types of Commercial Applications

Mueller Climatrol

Type 253 Horizontal Oil-Fired Furnace

Compare these features

Welded Steel Heat Exchanger — *Updraft* flue travel. Long flue travel assures top efficiency. High, insulated crown sheet — will not burn out.

Handsome Casing—Trim, compact, easily accessible. Entire unit cleanable without removing casing.

Large, Quiet Blower — To provide required CFM with lower blowerspeeds—thus reducing vibration sounds and insuring longer life.

Shipped Assembled—Pre-wired with fan and limit switch in position. Factory tested before shipment.

Here is an outstanding new horizontal oil furnace with unique design features which assure more efficient and quieter operation — with longer life. It can be suspended for application as a blower unit heater in all types of commercial installations, including garages, paint shops, hangars, stores.

Initially, this unit is available in one size—110,000 Btu input. Soon to come are sizes up to 225,000 Btu input. It is available with either of two efficient Mueller pressure atomizing oil burners, and can easily and inexpensively be converted to gas.

Write for full information on this new Mueller Climatrol horizontal oil furnace. Use the convenient coupon.

95th Anniversary — Mueller Climatrol

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Send me more information on your new Type 253 Horizontal Oil-Fired Furnace.

Name .....
Company .....
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City .....(...) State .....

E-56A

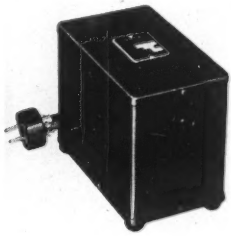
(Continued from page 200)

shaft seal affords the advantages of more efficient sealing and prevents air leakage into the pump when it is operating under suction lift, the manufacturer states. The double seal also has a longer service life under conditions when the pump is handling gritty and abrasive liquids. Casing design has been made more compact, and the elimination of stuffing boxes has decreased the shaft length between bearings, making the shaft more rigid. The shaft is not threaded, reduced, or slotted at any point over its unsupported length.

Industrial Dial Indicator for Temperature and Pressure

HPAC 17—Dial indicator, for panel or individual mounting, designed for temperature, pressure and load applications in industrial processing—Taylor Instrument Cos., 95 Ames St., Rochester 1, N. Y. The pointer is equipped with a micro-adjustment for easy and accurate zero settings, and the stainless steel movement is designed to eliminate linkage errors, the manufacturer states. The case of die cast aluminum is so constructed that it may be face or flush mounted, and bottom or back connected. The instrument provides for almost universal actuation by any variable that makes use of a Bourdon spring as an energy-to-motion converter. For temperature applications, actuations available are mercury, vapor, gas or organic liquid. Range is −100 to 1200 F. For pressure applications, range is 12 to 20,000 psi.

Indicator



Booster

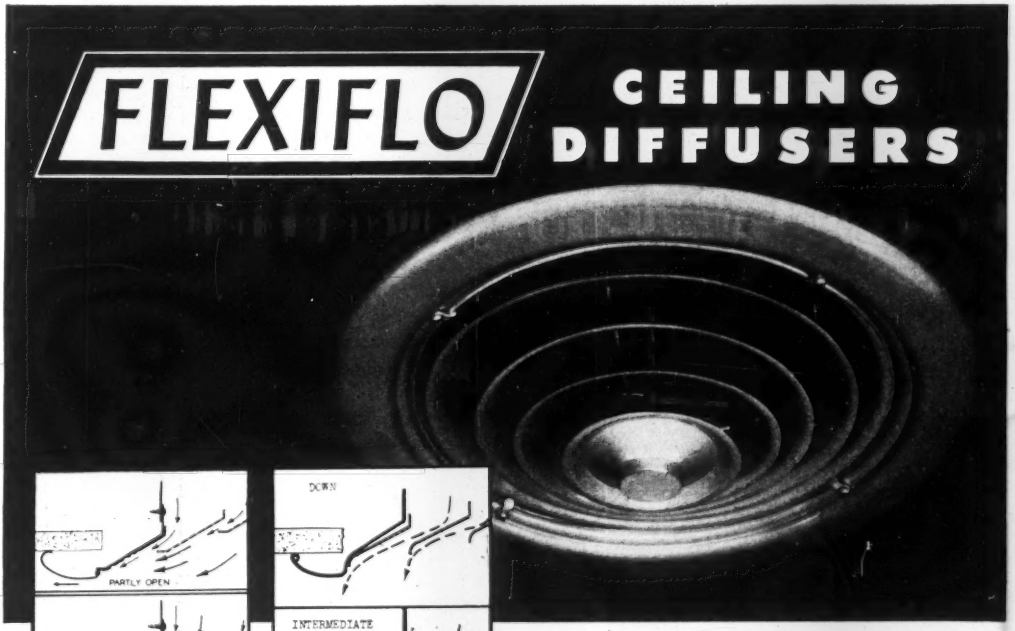
Automatic Voltage Booster

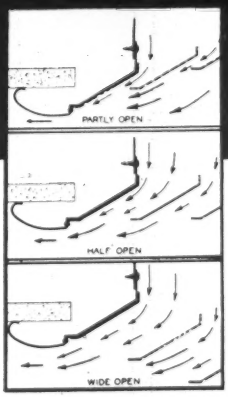
HPAC 18—Single step automatic voltage booster of sufficient rating to handle motor starting loads in areas where fluctuating low voltages are prevalent—Sola Electric Co., 1633 W. 16th St., Chicago 50. It is designed for use with such motor operated appliances as air conditioners and pumps. Automatic operation is effected through use of the "Sensivolt" votage sensitive a-c control. If line voltage drops to about 105 volts or lower, the booster is automatically connected into the circuit; when voltage rises to about 110 volts or more, it is automatically disconnected. The booster plugs into the regular line outlet and the motor power cord into the booster socket.

Double Seated Diaphragm Regulating Valve

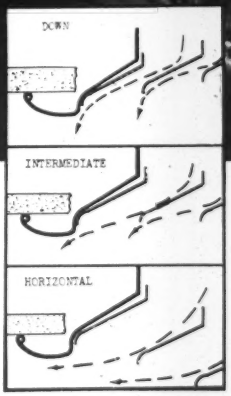
HPAC 19—Class DV double seated diaphragm regulating valve for use with control instruments in process industries — Leslie Co., 51 Delafield Ave., Lyndhurst, N. J. The "Flow-Line" contoured body has been designed to provide ISA standard face-to-face dimensions with the highest capacity, and lowest turbulence and body pressure

FLEXIFLO CEILING DIFFUSERS

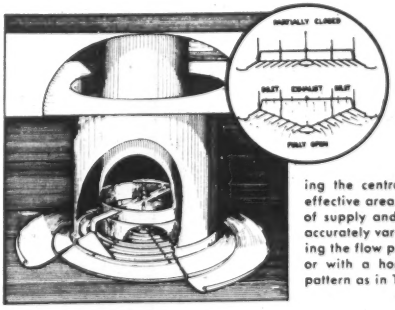




Type R, for cooling, gives a constant flow pattern, no matter what the opening.



Type V, for cooling or heating, with its special blades, permits change of flow pattern from horizontal to vertical.



Type CH, for heating, ventilating or cooling, is a combination supply and return outlet. Turning the central screw alters the effective area so that the volume of supply and return air can be accurately varied, without changing the flow pattern as in Type R, or with a horizontal to vertical pattern as in Type V.

for COOLING • VENTILATING AND HEATING

Enthusiastically received as a solution to many problems of air diffusion heretofore unsolved by other types, the Flexiflo meets the long-felt want for an air outlet of better design with complete, easy adjustability of air output and diffusion pattern.

The Flexiflo provides larger effective area for the required neck area than is available on any other types. Hence, it can handle larger volumes of air. The Flexiflo (Type R) provides infinitely variable air delivery without changing characteristic air pattern.

Exclusive in the Flexiflo are the built-in equalizing deflectors which are easy to adjust after installation.

The Flexiflo is equally efficient, whether installed on the ceiling or on exposed ducts. Wide range of capacities. Streamlined — beautiful, yet inconspicuous — rugged — the Flexiflo Diffuser truly helps make your heating or air conditioning installation a better engineered job.

Write for the Flexiflo Engineering Manual and Prices.

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Double check to find the difference in pipe hangers. There is a difference and it becomes apparent when journeymen use them. The difference results from engineered time-cost saving features. One way to discover the difference in pipe hangers is to use Square "Gee" Pipe Hangers on your next plumbing and heating jobs. You'll find that Grabler Square "Gee" Pipe Hangers give relief from time-wasting grief. Order them from your wholesaler.

Write for Wall Chart showing complete range of types of Grabler Square "Gee" Pipe Hangers and accessories.

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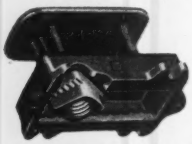
THE SQUARE "GEE" LINE INCLUDES: Malleable Fittings • AAR Fittings • Unions • Rail Fittings • Cast Iron Steam and Drainage Fittings • Patented Drainage Fittings • Copper Tube Solder-Joint Fittings • Steel Pipe Nipples • Hangers



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GRABLER

drop, the manufacturer states. The renewable interchangeable seat rings can be replaced without removing the valve body from the pipe line. There are also renewable self-aligning guides. The valve is available in sizes from 1½ to 10 in., for pressures up to 600 psi, and with screwed and flanged ends.

Valve

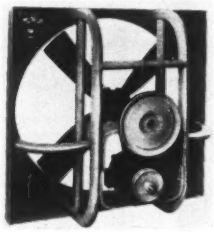
Analyzer

Combustion Analyzer

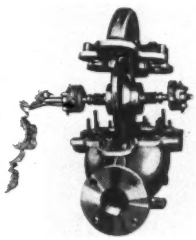
HPAC 20**—Model 140-A "Veco" complete combustion tester for measuring CO_2 content of flue gas, temperature of flue gas, and draft over fire — Victory Engineering Corp., Springfield Rd., Union, N. J. This two-probe instrument combines the accuracy of a laboratory Orsat type tester with all-electric ease of operation, the manufacturer states. Features include a glass coated electronic thermistor, a gas analysis cell with built-in compensator, and a filter-drier requiring six to eight squeezes of the hand aspirator. A series of readings can be taken without moving the probes, and a built-in thermocouple is designed to insure that flue gas temperatures are taken at the same point as CO_2 measurement.

Exhaust and Pressure Fan

HPAC 21—Type PLBD heavy duty belt driven fan for industrial applications, duct work, mine exhaust systems and filtering units where a large volume of air is required under static pressure — Chelsea Fan & Blower Co., Inc., 639 South Ave., Plainfield, N. J. It is equipped with non-overloading cast aluminum airfoil type propellers. Units are completely ball bearing and motors are totally enclosed. Fans are available in sizes from 24 to 48 in. and air deliveries from 5000 to 28,000 cfm.



Fan



Pump

Horizontal, General Service Pumps

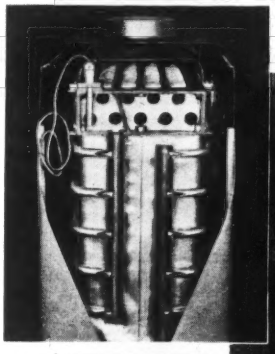
HPAC 22—Type AS horizontal, split-case, general service pumps which use standard mechanical shaft seals instead of stuffing boxes. — Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Ave. 26, Los Angeles 31. The manufacturer states that use of the mechanical shaft seals means the pump shaft is shortened

WHEN YOU *MUST* HAVE Strong Leak-tight Ductile JOINTS

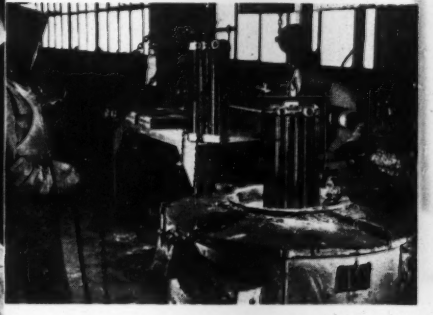
...braze with EASY-FLO

• This low-temperature silver brazing alloy just naturally and consistently makes joints that have all three of these properties—and does it fast and at surprisingly low-cost. That's why you'll find so many manufacturers in the heating, air conditioning and refrigerating industries brazing with EASY-FLO. The well-known RUUD water heater is a typical example. Here's the *inside* story.

Copper tubes are first brazed to large copper tube manifolds (above) — and then jigged and brazed to copper jacket. 3/32" EASY-FLO 35 wire does these jobs using torch heating — time, jigging included, 10 minutes. The same basic construction is used in RUUD house heating boilers.



Copper finned tubes and bronze headers are assembled in jigs with 1/16" EASY-FLO 45 wire rings at each joint — then brazed by dipping in hot salt bath as you see below.



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Expert aid in applying EASY-FLO brazing to your metal joining. No obligation. Ask for a Field Engineer.

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In boiler rooms or wherever else pipe insulation is needed for temperatures up to 600° F., you can look to Unarco Amocel for low-cost thermal protection. Amocel has many of the excellent features that make Unarco's higher-temperature insulation, Unibestos, so popular with industry. It's easy to apply; won't "powder" or slough-off. A normal installation lasts the lifetime of equipment or building. Phone your nearby Unarco Warehousing Distributor for Amocel from stock. Or write us for your Distributor's name and free copy of Bulletin 76-109.

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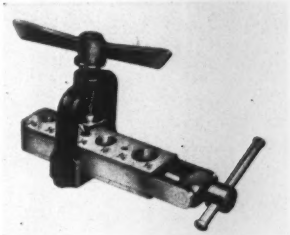
to half the length of shafts in conventional pumps of the same size, resulting in a more rigid shaft with reduced deflection. Since stuffing box housings are eliminated, the pump requires less floor space. The line is available in discharge sizes of from 1½ through 4 in. Capacity range is up to 750 gpm and head range to 230 ft. General application is for pumping water and clear liquids of up to 200 F, where no solids are in suspension.

Flaring Tool for Tubing

HPAC 23—Tool for flaring soft copper, steel, aluminum and brass tubing, which automatically burnishes the face of the flare after it has been formed — The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7. The tool will make 45 deg flares on $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{5}{8}$ OD tubing for standard SAE flared fittings joints. The burnishing action is effected through a lost motion mechanism



in the yoke which disengages the feed during the first revolution when backing off the cone. This causes the cone to burnish the flare, giving it a polished finish. The cone is made of hardened steel. The flare is formed in the air above the flaring bar instead of against a bevel in the bar, so that the original wall thickness of the tubing will be maintained at the base of the flare.

Evaporative Air Coolers

HPAC 24—1952 line of evaporative air coolers with provisions for controlled cooling — Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21. Two-speed motors will be standard equipment on the fan type cooler, and will be optional on four other commercial and residential models. The second speed on these models will permit delivery of cooling air at a lessened rate when desired. For window mounting models, the "Comfort Selector" is offered as an accessory. Installed in conjunction with certain models by means of a window mounting adaptor, it enables the window to be raised or lowered in front of the cooler grille to control air flow. In large commercial installations, an adjustable damper is installed in the duct system for cooling control.

Flow and Liquid Level Measurement and Control

HPAC 25—"Electronik" inductance bridge receiver, for measurement and control of flow and liquid level — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne & Windrim Aves., Philadelphia 44. The instrument combines a number of functions which formerly required the use of two instruments. It makes it possible to indicate, record, integrate and control flow and liquid level. Data can also be re-transmitted pneumatically to

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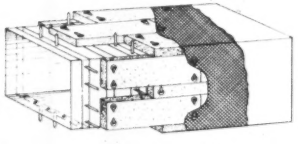
RIDGID
Work-Saver Pipe Tools

a second receiver remotely located. Accurate to within or ± ½ of 1 percent of full scale, the instrument can be used with any of the company's electric flow or motion transmitters.

Metal Strapping for Insulation Materials

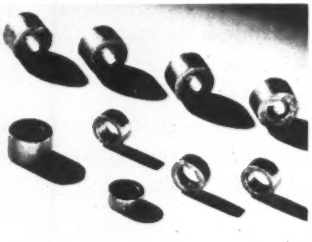
HPAC 26**—"Finger Strap" metal strapping for permanently applying insulation materials to pipes, ducts (as shown), tanks and flat walls — A. J. Gerrard & Co., 1950 Hawthorne Ave., Melrose Park, Ill. The strapping is ¾ in. wide in thicknesses from 0.015 to 0.035. ¼ in. wide tapered fingers are spaced at intervals of 5 to 12 in. as specified, serving to secure insulation. The strapping



is applied around tanks, ducts or pipes with a steelbinder strapping tool. It can also be nailed or screwed to flat surfaces. Once fastened, the steel fingers are lifted outward to a 90 deg angle and the insulation impaled on them. A slit washer is slipped on the tip protruding through the insulation, and the tip is bent back against the washer. The strapping is available in continuous coils in plain steel, galvanized, stainless 430, or monel.

Semi-Metallic Packing Base for Die-Formed Rings and Washers

HPAC 27**—Die-formed rings or washers manufactured from a new semi-metallic base which fills in minor irregularities existing in machined stuffing boxes, bonnets, glands, stems or rods — Abbott & Biddle, 2113-27



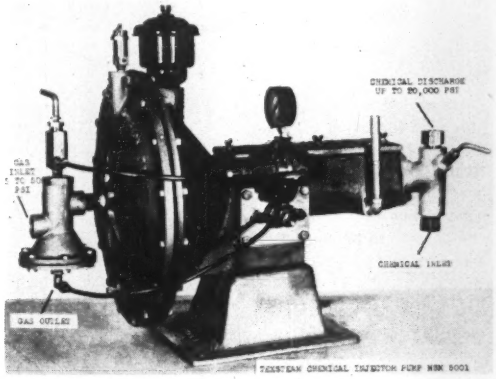
Federal St., Philadelphia 46. Designed for use by manufacturers of valves, pumps, fittings, meters, etc., the die formed rings or washers lower machining costs through more lenient tolerances, the company states.

Oxygen Generator

HPAC 28—Semi-portable oxygen generator for use in the steel, glass, metal fabrication, chemical and process industries — Joy Mfg. Co., Henry W. Oliver Bldg., Pittsburgh 22. The unit requires a space of 600 cu ft, and models are planned in the size range from 0.5 to 12 tons daily capacity of oxygen of 99.5 percent purity. A series of automatic reversing heat exchangers are used, eliminating the need for chemical purification of the air. The manufacturer estimates that oxygen can be produced at an operating cost of five to 10 cents per 100 cu ft, depending on how much of the time the unit runs.

Chemical Injector Pump

HPAC 29**—High pressure chemical injector pump (Model MSM 5001), designed to produce up to 20,000 lb discharged pressure from 50 lb feed pressure of air, gas, water or steam — Texsteam Corp., 320 Hughes St., Houston 11. The pump is designed to inject a liquid chemical into another liquid against 20,000 lb pressure. Feed pressures are adjustable from 5 to 50 lb to give output pressures of 100 up to 20,000 lb. The volume of liquid discharge can be set to deliver ½ pint to 360 gal per 24 hr period. The pump weighs 62 lb and is supplied with ¼ or ½ in. stellite pistons and valves when used for



TEXSTEAM CHEMICAL INJECTION PUMP MSM 5001

sustained high pressure. For lower pressures, 1 in. stainless steel pistons and valves are used. The pump, developed to inject chromates and rust inhibitors into high pressure oil and gas lines, is also applicable to handling other chemicals, in production testing of valves and piping systems, for laboratory use, etc.

Liquid Level Alarm

HPAC 30—"Ventalarm" signal (a three piece assembly) for guarding against overflow and spillage in heavy oil tank installations or other viscous liquids — Scully Signal Co., First St., Cambridge 41, Mass. The pressure vent cap goes on a 2 in. vent pipe. It contains a metal disc which opens at 4 oz of pressure. If a regular vent line is larger, two caps can be teed together. The intrusion assembly threads into a 2. in tank opening and projects into the tank. It is threaded at top to receive the ¾ in. iron pipe signal line. The whistle signal assembly should be installed in an inverted position for weather protection. The case contains a whistle and screen. An aperture in the whistle acts as a vacuum breaker during oil withdrawal.

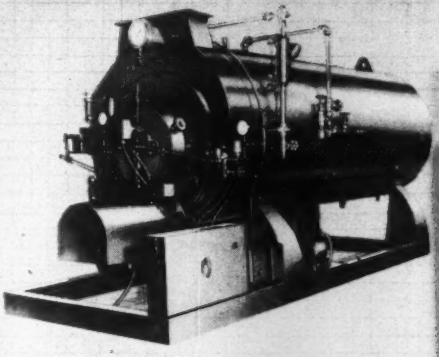
Meter for Steam, Air or Gas

HPAC 31—Redesigned Model SMKS "Shuntflo" meter for steam, air or gas — Builders-Providence, Inc., 345 Harris Ave., Providence 1. According to the manufacturer, the streamlined damping chamber facilitates a more uniform cooling system; the all-Mechanite body casting provides greater strength and durability; a simplified rotor mechanism assures greater efficiency and easier replacement of parts; and a strengthened rotor shaft is designed to withstand slugs of undue condensate or sudden line

3=5

when you use

Cyclonic Combustion!



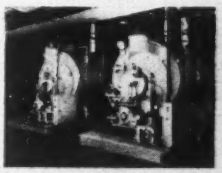
Yes, 3 square feet of heating surface with Cyclonic Combustion equals the 5 square feet of heating surface offered to you by other packaged boiler units.

The Cyclotherm Cyclonic Combustion Principle is an entirely new and amazingly different method of heat transfer in the boiler industry.

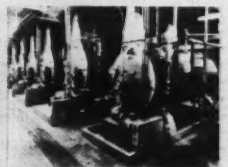
Air enters the combustion chamber at extremely high velocity in a revolving spiral vortex which travels the entire length of the furnace. The fuel is introduced into the entering air where it is slowly consumed as it moves in a cyclonic motion down the combustion chamber. This highly luminous slow burning flame radiating heat to the fire tube through direct radiation and by convection, results in an unusually high rate of heat transfer.

Boilers are designed for oil or gas operation from 18 through 500 HP, 15 to 200 lbs. operating pressure.

Full power operation from a cold start in 15 to 20 minutes. Savings up to 50% on maintenance. Guaranteed 80% efficiency.



When large installation requirements exceed 500 HP, sizable fuel savings can be obtained by battery installations. Based on an analysis of your steam requirements, a number of units would be recommended which collectively add up to your peak steam demand.

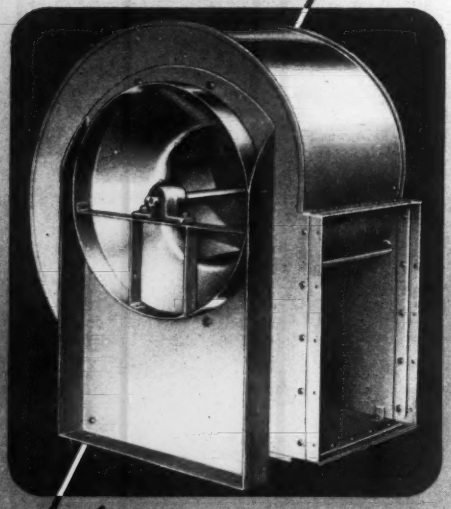


On one typical installation as shown above, a battery of 200 HP Cyclotherms has saved over $12,000 a year in fuel alone. Maintenance and operational cost have been reduced to 75%.

CYCLOTHERM steam generators
CYCLOTHERM DIVISION UNITED STATES RADIATOR CORP.

CYCLOTHERM, DEPARTMENT 26, OSWEGO, NEW YORK

ALADDIN FANS



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- CERTIFIED RATINGS

You will find that ALADDIN Fans are available in many types . . . each ruggedly built and fully equal to the job for which it is intended. Thousands of ALADDIN Fans are now in service meeting the air-handling requirements of every essential industry, from chemical to aircraft, on farms and aboard ships.

More and more architects and engineers have come to know ALADDIN Fans . . . and to recognize their merits of quality and dependability.

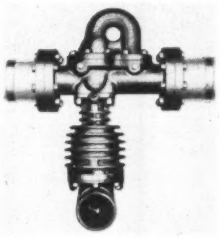
Write for complete data

ALADDIN HEATING CORPORATION

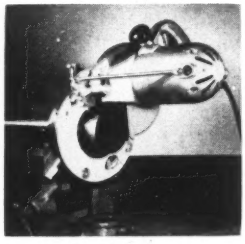
2272 SAN PABLO AVE., OAKLAND 12, CALIFORNIA

REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

pressure fluctuations. The meters are used by district heating companies and in industry for departmental heating and process work.



Meter



Saw

Power Cut-Off Saw

HPAC 32*—Power cut-off abrasive saw for cutting pipe and tubing of aluminum, copper, stainless steel, etc., in varying wall thicknesses — Tri-Clover Machine Co., Kenosha, Wis. It uses standard 110 volt a-c current. A heavy duty abrasive disk does the cutting, leaving smooth, square, non-distorted ends, the manufacturer states. The cut-off saw is attached to a free moving, rotating frame. The operator sets the saw to make the cut, and then rotates it 360 deg on the frame, cutting around the periphery of the tube or pipe.

Water Testing Kit for Petroleum

HPAC 33**—Water testing kit for petroleum, comprising "Tanktex" water finder paste, and a "Findicator" measuring instrument — The Tankit Co., 17 Shepard Ave., Newark, N. J. The paste turns from green to red at water level. The measurer is a tubular indicator of oil resistant plastic, marked in gradations up to $6\frac{1}{2}$ in. The paste is smeared on the indicator, which is then lowered into the tank on an 8 ft oil resistant plastic line attached to a wooden reel.

Above: Bearing

Left: Kit

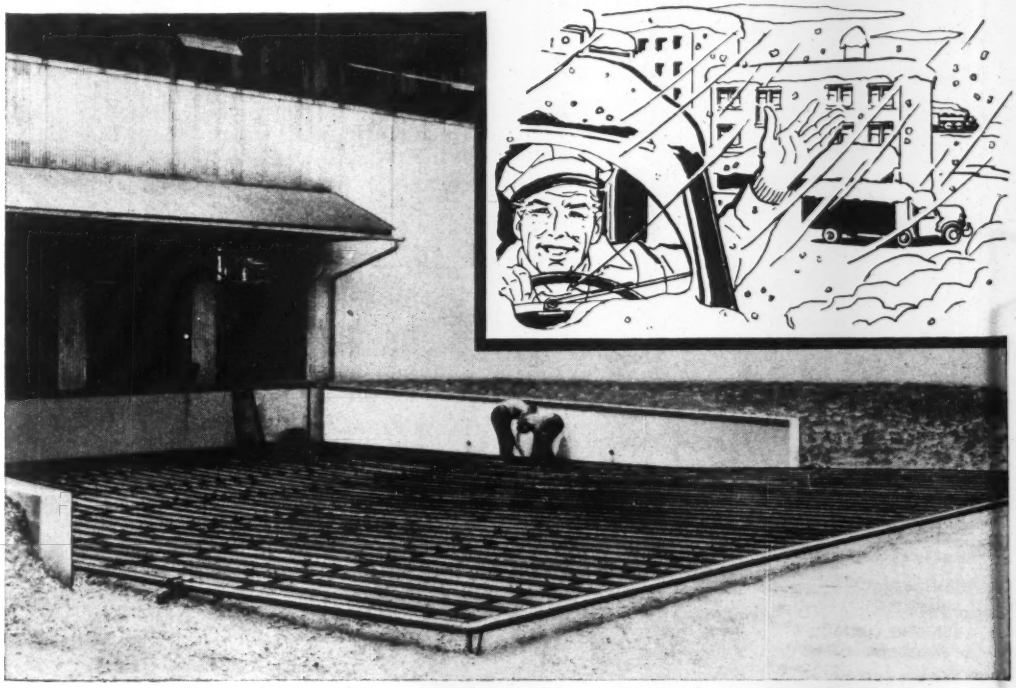
Vacuum Pump Seal Bearing

HPAC 34—Two purpose bearing which supports a shaft and also acts as a seal support — Bronze Bearings, Inc., 860 North Ave. East Cranford, N. J. The metal, a high lead tin bronze, was selected for general utility, affording medium tensile strength and good bearing qualities, the manufacturer states.

Continuous V Packing

HPAC 35—"Continuous-Vee" chevron-type packing designed for 500 to 6000 psi, and available in styles for either high or low temperatures — Mechanical Packing Div., Flexrock Co., 3670-B Cuthbert St., Philadelphia 4.

"Just a Breeze" in any Snowstorm!



No stuck trucks at loading docks with steel pipe snow melting

All the precious time gained, high-balling the highway with urgently needed cargo, or making fast work of local deliveries, can be lost forever by a jam at an inclined or declined loading or receiving dock, caused by just a skim of ice or a mere half-inch of snow to say nothing of a heavy storm!

Yet for a comparatively minor investment, dock approaches and aprons can be kept snow and ice free all winter long. So, far-sighted managements are licking this weather problem at the docks with steel pipe snow melting systems . . . and the big wheelers roll in and out "in a breeze."

Snow melting and steel pipe go hand-in-hand. Economy in purchase and durability in service make it a natural for this application. Add the important factors of formability and weldability for panel fabrication and you have the reasons why steel pipe is first choice for snow melting systems—and why it's the most widely used pipe in the world!

Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N.Y.

NEW smoothness... NEW efficiency
in powder-actuated fastening...

Ramset

JOBMASTER

ANOTHER
RAMSET
FIRST
Designed
BY Operators
FOR Operators

SEE THESE
NEW FEATURES:

- 1-PIECE TOOL, *for faster loading*
- TRIGGER ACTION, *for easy operation*
- PORTED BARREL, *to reduce spall*
- ANGLE-FIRE CONTROL, *for straight penetration*
- VISI-CHEK BUTTON, *for quick inspection*
- *Plus exclusive, proved-in-use* ROTO-SET SAFETY SHIELD, *for accurate positioning*

Faster, lighter, easier handled, the new RAMSET JOBMASTER sets a record pace for steel and concrete fastenings. Properly trained workmen quickly become skilled operators because of smooth, simple, natural motions of loading, placing, firing. Positive controls bring improved accuracy and efficiency ... and still lower fastening costs. Ask your dealer for demonstration of how RAMSET's years of pioneering have made the new JOBMASTER the proved-in-performance leader.

Ramset Fasteners, Inc.
12117 BEREA ROAD • CLEVELAND 11, OHIO

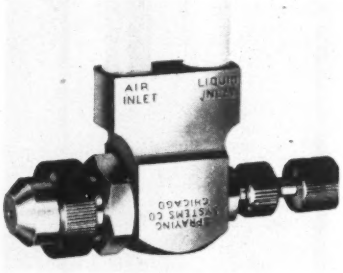
ASK FOR DEMONSTRATION TODAY!

Product Patent No. 2470117. Other Patents Pending.

It is furnished in sizes from ¼ to 1 in., by $\frac{1}{16}$ in. increments, 25 ft per spiral. The user cuts his own rings on the job, to fit specific rod and stuffing box dimensions. The packing is offered in two styles: one, constructed of asbestos cloth and neoprene, is designed for high temperature service on reciprocating steam or air rods, hot oil pumps, etc.; the other, of cotton duck and neoprene, is for lower temperature service on hydraulic rams, outside packed plunger pumps, etc., handling oil or water.

Pneumatic Atomizing Nozzle

HPAC 36—Pneumatic atomizing nozzle with both air and liquid inlets positioned at the top of the nozzle body, at right angles to the direction of spray — Spraying Systems Co., 3219 Randolph St., Bellwood, Ill. The model



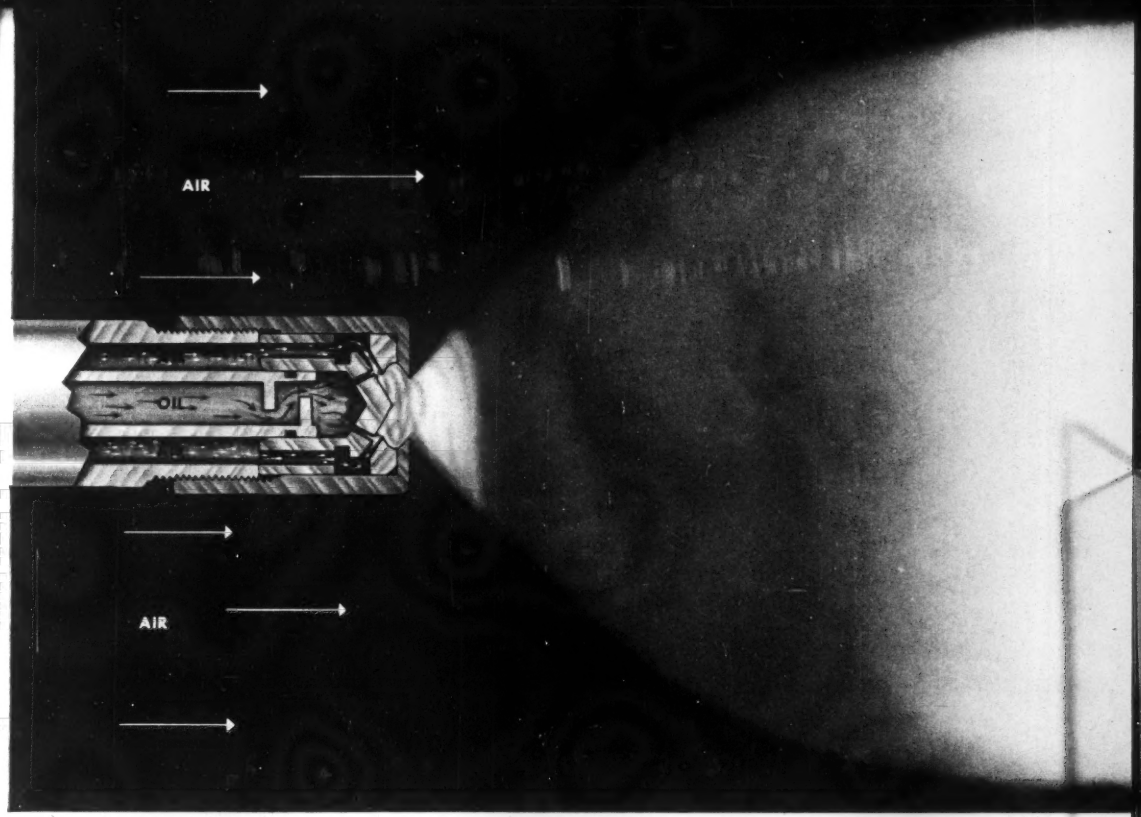
illustrated is supplied with shutoff needle. The same design nozzle is also available without the needle. Capacities of these nozzles and the types of spray are determined by the fluid and air nozzle assemblies. A wide range of assemblies of set-ups are available to provide pressure or siphon set-ups with round, wide angle round and flat sprays.

EQUIPMENT BRIEFS

RUBBER MAT WITH BUILT-IN RADIANT HEATING UNIT for use in theaters, warehouses, unheated or refrigerated areas of industrial plants, etc. — Mechanical Goods Div., United States Rubber Co., Rockefeller Center, New York 20. The heater looks like a rubber floor mat. Its center, however, contains a layer of electrically conductive rubber which comprises the heating element. It operates on 110 volt current. Normal operating temperature is about 35 F above the surrounding temperature.

"GALFALLOY" GALVANIZING COATING BAR FOR METAL FABRICATION, now reduced in length from 16 to 14 in. for easier handling and to reduce possibility of breakage — Metalloy Products Co., 1351 E. 17th St., Los Angeles 21. The material will bond to any metal without the use of flux, according to the manufacturer.

"IOLYTE" POLYESTER LAMINATED SHEETS which may be fabricated into ducts, pipe, tube, tanks or molding shapes, now available in continuous strips of any desired length, in thicknesses from 8 mils to ¼ in. or more — Industrial Organics Corp., 59-31 54th St., Maspeth 78, N. Y. It withstands continuous exposure to temperatures up to 350 F, has low water absorption, is highly resistant to chemicals and has good electrical properties, the manufacturer states.



NOW—only Powermaster gives you VORIFLOW combustion!

LATEST DEVELOPMENT IN BURNER DESIGN REDUCES COSTS AND INCREASES BOILER EFFICIENCY

Here's what *Powermaster's* new VORIFLOW burner will do for you:

1. Saves fuel by providing infinitely variable combustion modulation in response to demand—with *full efficiency*—through wide range from 30% to 100% of firing capacity.

This means elimination of waste and maintenance headaches because of incomplete combustion. With the exclusive design of the VORIFLOW burner, tiny jets of compressed air pulverize every droplet of oil . . . projecting a fine fog of oil/air emulsion into the combustion area where it ignites and burns —immediately and completely. The VORIFLOW burner does away with outmoded mechanical spinning devices, globules of wasted oil, and gummy cleaning problems.

2. Slashes boiler maintenance costs.

There are *no* moving parts to wear out • There is *no* cup to clean daily. Routine cleaning of the burner once a month is sufficient • There is *no* burner vibration to throw adjustments "out of whack" • Parts are made of stainless steel, brass, and beryllium copper—they will last indefinitely.

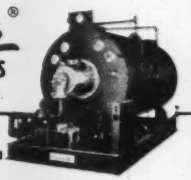
3. The combination burner permits rapid change-over from one fuel to another—light oil, heavy oil, or gas.

And when we say "rapid" we mean just that—the job can be done in four minutes. Modulating firing controls are ready to go into action at the flick of a switch. It isn't necessary to change the entire burner assembly. All you need to do to fire gas is to remove the oil nozzle.

Before deciding on a boiler for your plant, be sure to get the facts on the newest POWERMASTER with VORIFLOW combustion. Write for this catalog that gives you the entire story of the *Powermaster* packaged automatic boiler. Just drop us a line and we'll put one in the mail for you.

YOUR CUSTOMERS and PROSPECTS are reading this message. It tells why the Powermaster gives outstanding performance. We'll be glad to send you more information.

Powermaster®
PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • Established 1885 • **1000 Morgantown Road, Reading, Pennsylvania**

Gold Depository in Fort Knox, Kentucky

. . . more important than gold!

The most important metal today is not the tons of gold buried at Ft. Knox!

Far more important are the millions of tons of iron and steel scrap so desperately needed to make new steel. All scrap, actual and potential, needs to be gathered up and channeled to the steel producing plants-NOW, today, tomorrow and tomorrow. So long as the steel industry is called upon to produce two million and more tons of ingot steel per week, it must have one million and more tons of scrap each week.

Steel producers are getting the iron ore, limestone and coal they need. But the scrap situation is critical and will continue to be so until inventories are built up substantially.

As a user of steel--as one interested in seeing that America's rearmament program is not too little and too late--you can do your part to see that your community and your business keep scrap moving toward the mills.

YOUR SCRAP YOUNGSTOWN IS NEEDED

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

WE HEAR THAT . . .

IRON FIREMAN MFG. CO., Cleveland, has purchased the "Petro" oil burner business from *PETROLEUM HEAT AND POWER CO.*, Stamford, Conn. The entire line of domestic, commercial and industrial oil burners and oil heating equipment will be manufactured at Iron Fireman's Cleveland plant. *J. R. CREWS* is sales manager of the new Petro Div. The Petro sales organization will remain entirely separate from that of Iron Fireman. No Petro equipment will be sold through Iron Fireman dealers or branches, but will be sold through the jobbers handling Petro, and the retail branches of the Petroleum Heat and Power Co.

BARBER COLMAN CO., Rockford, Ill., is purchasing the principal assets of *WHEELCO INSTRUMENTS CO.*, Chicago. Wheelco products consist of indicating, recording, and controlling industrial instruments, and combustion safeguards. Plans are to continue operations in Chicago until manufacturing facilities can be gradually transferred to Rockford. No changes are contemplated in Wheelco's national sales and service organization.

THE L. J. WING MFG. CO., Linden, N. J., recently held a reception and supper for all of its employees, after which service buttons were awarded to all employees who had been with the company from ten to fifty years. Fifty years' service was noted for *HARRY S. WHELLER*, president; 40 years for *W. W. WILSON*, vice president; and 30 years for *C. H. SMITH*, secretary.

An addition of 37,000 sq ft to its present plant has been started by *D. J. MURRAY MFG. CO.*, Wausau, Wis. Breaking ground ceremonies were held recently, and completion is scheduled for September.

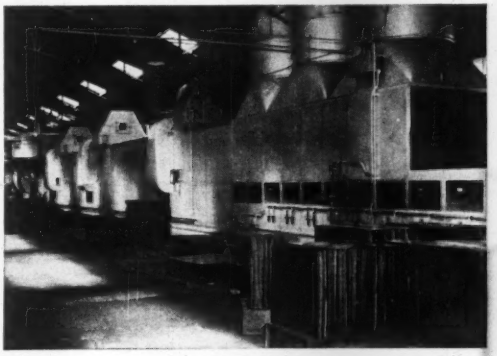
The Dunellen, N. J., plant of *WORTHINGTON CORP.*, Harrison, N. J., has been redesignated as the Plainfield Works (address: Plainfield, N. J.).

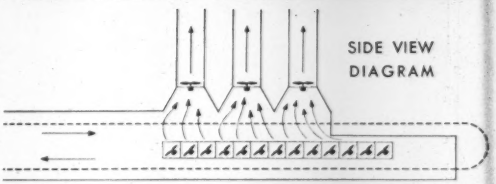
Founded 62 years ago, *THE BURT MFG. CO.*, Akron, celebrated its golden anniversary of incorporation with an open house recently. The company has acquired all the remaining buildings in its block, and remodeling of the property will be completed by next year.

According to reports made to *MITCHELL MFG. CO.*, Chicago, hatchery operators using the company's air conditioners have raised hatchability of eggs by 10 to 20 percent. With proper temperature control, the company states, one man can raise as many as 160,000 chickens in a year, without investing heavily in incubator equipment. Newly laid eggs can be held at 55 F and 80 percent relative humidity until a busy incubator is ready to start the hatching process.

REGINALD JAMES SEYMOUR PIGOTT has been named recipient of the Egleston Medal for 1952, an award

How RHEEM cools off 500° lithographed metal in 5 minutes





Propellair fans do an effective job

Rheem Manufacturing Co. has one of the world's largest units for drying lithographed metal at their New Orleans Plant. The equipment, developed by Wagner Litho Machinery Division, roller coats, bakes and cools metal for 55-gallon drums—all in one continuous operation.

The problem of cooling the metal from 500° to room temperature and exhausting heat and fumes was solved by the installation of Propellair Fans (direct connected type). As shown in the drawing above, twenty-six 1 HP, 30-inch fans provide high velocity air movement over the coated metal [illegible], blowing heat and fumes into a tunnel. Here three 60" fans (each 15 HP, 79,000 CFM) with glass-insulated motors take over, exhausting heat and fumes high over the roof. Rheem reports this ventilating system does a most effective job, economically.

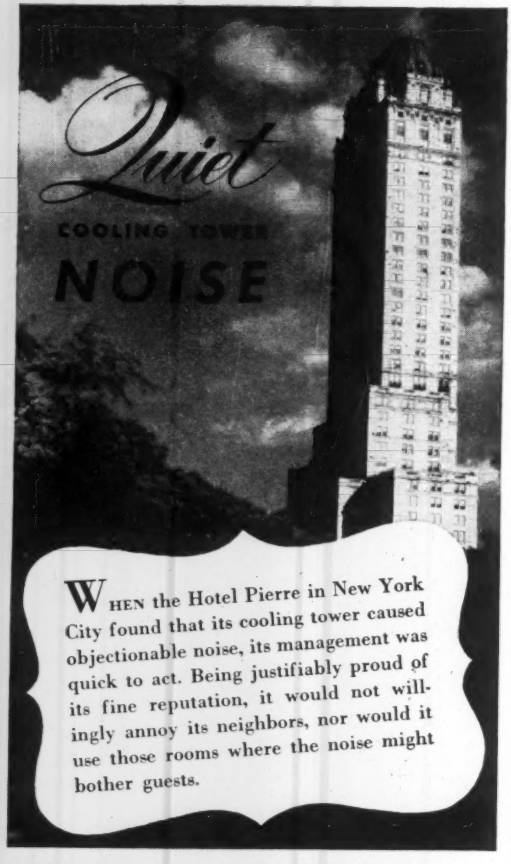
What's your ventilating problem?

For over 20 years Propellair has been solving tough air moving problems for leading companies. Propellair Fans are economical—in initial cost, in operating expense, in maintenance. Above all, they are rugged and dependable. Features include cast aluminum airfoil propellers, curved airfoil entrance rings, R & M motors, certified air deliveries.

Tell us your ventilating problem and our engineers will give you their recommendations, without obligation.

Write for Bulletin H-3238

PROPELLAIR®
DIVISION OF ROBBINS & MYERS, INC.
SPRINGFIELD · OHIO



WHEN the Hotel Pierre in New York City found that its cooling tower caused objectionable noise, its management was quick to act. Being justifiably proud of its fine reputation, it would not willingly annoy its neighbors, nor would it use those rooms where the noise might bother guests.

INDUSTRIAL SOUND CONTROL, INC. measured the sound level and determined just what sound insulation was needed, and where, and quickly and effectively quieted the noise—to the entire satisfaction of the Pierre, its guests, and its neighbors.

Don't risk your precious public relations because of cooling tower noise. Call on ISC, pioneers since 1937 in cutting BIG NOISES down to WHISPERS. The methods which ISC uses to quiet test cells of the newest and most powerful jet engines, can also solve your noise problems.

(INDUSTRIAL SOUND CONTROL, INC. were the originators of industrial sound proofing, and their installations are job-proven over the years.)

Write **ISC** *today!*

Mid-Western distributor: Midwest Industrial Sound Control, Inc.
1455 North Pennsylvania Street, Indianapolis 2, Indiana

Industrial Sound Control, Inc.
45 GRANBY STREET HARTFORD, CONN.
2119 SEPULVEDA BLVD. LOS ANGELES, CALIF.

presented by *COLUMBIA UNIVERSITY*, New York, for distinguished engineering achievement. The presentation was made recently to Mr. Pigott, who is presently director of the engineering division of Gulf Research and Development Co., Pittsburgh, a subsidiary of the Gulf Oil Corp.

Housewarming ceremonies were held recently at the new $1,500,000 Chicago warehouse of *AMERICAN BRASS CO.*, Waterbury, Conn. The warehouse, located at 4501 W. North Ave., has 62,500 sq ft of floor area, and is seven times larger than the firm's former Chicago place of business.

A comprehensive sales training program to develop well-informed salesmen-technicians has been undertaken by the Welding Products Div., *A. O. SMITH CORP.*, Milwaukee. Eight weeks are spent learning techniques of electrode manufacturing. Then 12 weeks are spent in the welding research laboratory, after which trainees are placed in the welding equipment manufacturing plant, and then in divisional sales offices.

GEORGE F. DRISCOLL CO., general contractors, New York, recently celebrated the 50th anniversary of its founding.

WATTS REGULATOR CO., Lawrence, Mass., recently held a five-day extensive training session for all of its field representatives, to acquaint them with a number of new products the company has developed for the heating and plumbing industries.

REYNOLDS METALS CO., Louisville, anticipates that within five years, at least three billion lb of aluminum will be going into construction yearly. Even under the restricted conditions existing during 1951, more than ½ billion lb went into this field. The company's market information indicates that sales could reach a billion pounds in two years.

A shipment of heating equipment made in Scotland by John Kerr & William Kerr, Ltd., arrived recently in the U.S. for delivery to *WARREN WEBSTER & CO.*, Camden, N.J. The shipment is one of several arranged to supplement U.S. production during the curtailment of aluminum and copper because of the defense program.

Eleven employees of *DRAVO CORP.*, Pittsburgh, have been presented with cash awards totalling $1200 for their winning entries in the company's 13th annual technical papers contest.

The new room dehumidifier of *FRESH'ND-AIRE CO.*, Chicago, a portable electric unit, is being used in hotels and motor courts to speed paint drying in newly decorated rooms, according to reports received recently by the company.

Twenty-six sales engineers have been added to the field sales staff, Industrial Div., *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis. The new men recently have completed a 13 week training course in instrument maintenance at the the company's Brown training school in Philadelphia. They have been assigned to 20 of the nearly 100 branch offices in the U.S.

This year *BURGE ICE MACHINE CO.*, Chicago, is celebrating 50 years of continuous business. Six years after *E. H. BURGE* had established his company, *JOSEPH L. BAKER*, founder of Baker Ice Machine Co., Omaha, made an agreement with Mr. Burge who was to sell Baker refrigeration equipment in Illinois, Indiana, Michigan and Wisconsin, thus beginning an association that has endured through the years.

A patented method for predicting in advance the hardening characteristics of steel compositions has been made available to the public by *U.S. STEEL CO.*, Pittsburgh. The patent was issued in the name of *DR. MARCUS A. GROSSMANN*, and assigned to the company, where he is advisor in research planning. As varying degrees of "hardenability" are indexes to the usefulness of steel for specific tasks, this knowledge will enable operating men to produce the types of steel that will exactly suit diverse applications in defense production.

Benjamin Franklin, inventor, joined with the *FITZ-GIBBONS BOILER CO., INC.*, at the Oil-Heat exposition in Philadelphia, to display his original Franklin Stove for comparison with the company's modern line of steel boilers. Ben was impersonated by *WILLIAM H. MacFARLAND, SR.*, of Philadelphia.

UNITED STATES AIR CONDITIONING CORP., Minneapolis, has announced that its five year protection plan, which has been offered on packaged air conditioners for the past three years, has been augmented by more liberal labor allowances on repair work and payment of freight charges for replacement parts. The protection policy is included in the standard price of the equipment.

Establishment of an "Oscar" award (an all expense trip to Hawaii) was announced at the recent annual meeting of representatives of licensed applicators for *ZONOLITE CO.*, Chicago. The award will be made next year for the applicator making the greatest contribution to the "Z-Crete" industry.

Field representatives of *BRUNER CORP.*, Milwaukee, gathered at the Milwaukee Athletic Club for a four day series of engineering and sales meetings with factory representatives and *T. W. BRUNER*, company president. The purpose was to describe the new line of commercial water softeners. The company is expanding its activities in the industrial and commercial lines. Although the company carries in stock seven heavy duty sizes of softeners and filters, larger installations are currently being constructed and custom built to specifications.

which dominates the New York skyline, is famous the world over as an architectural and engineering marvel.

When air conditioning was installed, the specifications included suppression of cooling tower noise, and the job was engineered by Industrial Sound Control, Inc., using ISC "Soundmetal" panels.

Whatever your noise problem, call on ISC —the originators of industrial soundproofing materials and methods. Its installations, completely engineered to solve the individual problem, range from test cells for the most powerful jet engines to soundproofing a small compressor.

Write today for ISC's free booklet "Sound Facts."

Midwestern distributor: Midwest Industrial Sound Control, Inc., 1455 North Pennsylvania Street, Indianapolis 2, Indiana.

SILENCE SERVICE

Industrial Sound Control Inc.

45 Granby Street, Hartford 12, Conn.

2119 SO. SEPULVEDA BLVD., LOS ANGELES, CALIF.

WHO'S WHAT

PAUL B. HOLMES has resigned as assistant director, *BUILDING MATERIALS DIV., FACILITIES & CONSTRUCTION BUREAU, NATIONAL PRODUCTION AUTHORITY*, after 13 months' service. He was appointed with the understanding that he would return to private industry in about a year, assuming no all-out emergency. He will continue to serve as a consultant to the Building Materials Branch.

JOHNSON SERVICE CO., Milwaukee, has elected *J. S. O'GORMAN, JR.* formerly manager of the Detroit branch, as a director, to fill the vacancy left by the late *O. G. WARD*. *L. V. ZACHARYASZ*, formerly assistant secretary and assistant treasurer, is now secretary and assistant treasurer. *HERBERT H. KOEPKE* has been elected assistant secretary and personnel manager.

Three new vice presidents have been elected by *WESTINGHOUSE ELECTRIC CORP.*, Pittsburgh. *W. W. SPROUL*, formerly sales manager, industrial products, is now in charge of the general industrial products group of divisions. *L. B. McCULLY* is now heading the East Pittsburgh divisions, of which he had been manager. *H. E. SEIM* heads the Sturtevant Div. and the Bryant Electric Co. Formerly, he was general manager of both operations. *RUSSELL B. READ*, former director of payroll accounting, has been appointed planning director. He is succeeded by *FRANK H. MUNS*, who has been assistant director.

Officers elected at the recent annual meeting of the *SHEET METAL CONTRACTORS NATIONAL ASSOCIATION* are: president, *ANGELO HOFFMAN*; 1st vice president, *A. J. SABATINE*; 2nd vice president, *DEE CRAMER*; 3rd vice president, *PAUL STROMBERG*; and treasurer, *C. M. GUNDLACH*. The new directors (term ending 1955) are: *CLARENCE MEYER, H. WALLACE, CLYDE PARRIOTT*, and *R. J. MUNZLINGER*. Replacing Mr. Cramer as director, with term ending in 1954, is *NAT LEAS*.

CHARLES E. BENNETT, president, The Manufacturers Light and Heat Co., and vice president, *AMERICAN GAS ASSOCIATION*, has been elected president of the association.

RAYMOND A. RUGGE, formerly president and general manager, Kilgore Mfg. Co., Worthington, Ohio, is now chief engineer, Aeronautical Div., *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis. In addition, *WILLIAM H. STEINKAMP* has been appointed sales manager, Industrial Div., of which he has been field sales manager since 1943. He succeeds *L. MORTON MORLEY*, who continues as vice president of the Brown Instruments Div., and who will assume greater responsibilities concerning division policies. Mr. Steinkamp is succeeded in his former post by *O. B. WILSON*, with the Brown division since 1923.

Get the COMBI-MATIC
for Automatic Sales
• The NEW G-3A Burner (illustrated here) is versatile in application and can be used for a multitude of installations as a straight gas burner or a combination gas and oil burner. The "COMBI-MATIC" will switch from gas to oil, either from a pre-determined setting of an outside thermostat or by manual control providing an uninterrupted fuel supply.
Siemon
Combi-Matic
BURNER
COMBINES OIL AND GAS
TRADE MARK REG U S PAT OFF
ECONOMICAL • DEPENDABLE • COMPLETELY Automatic Heat
Write for Literature
SIEMON and CO.
1819 HOLMES • KANSAS CITY, MO.

DONALD H. VANCE has been elected vice president of *THE KORFUND CO., INC.*, Long Island City, N.Y. He joined the company in 1941, and has served as executive engineer and assistant general manager.

The new sales manager, *KENNARD CORP.*, St. Louis, is *BEN M. McDOUGALL*, with the company for three years as assistant sales manager.

The *ATOMIC ENERGY COMMISSION* has established at Washington headquarters a new Office of Industrial Development headed by *DR. WILLIAM LEE DAVIDSON*, formerly director of physical research, B. F. Goodrich Co., Akron. The purpose of the office is to aid in the administration of the industrial participation program, and to expand the areas in which industry may find an interest in the national atomic energy program.

LYNCH CORP., Toledo, has elected *RUSSELL L. SEARS* a vice president. He has been with the company since 1944, most recently as general sales manager of the Ohio divisions.

JOHN M. DUMSER is the new director of sales, *WOLVERINE TUBE DIV., CALUMET & HECLA CONSOLIDATED COPPER CO., INC.*, Detroit. Formerly general sales manager, he replaces *GEORGE D. POTTER*, who has resigned to devote full time to the operation and sales program of the Corey Steel Co., Chicago, of which he is a vice president.

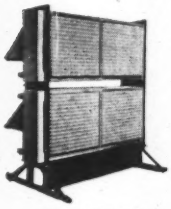
DeFOREST E. SANFORD, former head, Ammunition Div., has been named deputy chief, Engineering Dept., *U. S. NAVAL ORDNANCE LABORATORY*, White Oak, Md. He succeeds *DR. HAROLD J. PLUMLEY*, recently named chief, Physics Research Dept. *RAYMOND L. GRAUMANN* has been named acting chief, Ammunition Div.

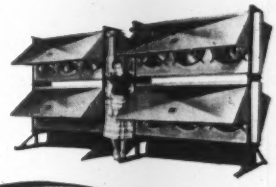
JOHN K. BEIDLER has been elected a director of *DRAVO CORP.*, Pittsburgh. He has been with the company since 1935, and recently was named general manager, Machinery Div., and director and vice president of Dravo-Doyle Co., a subsidiary.

AIR REDUCTION CO., INC., New York, has elected *GEORGE V. SLOTTMAN* as a vice president. He will continue as director of research and engineering.

DR. WILLIAM R. HAINSWORTH has joined the general engineering division of *RHEEM MFG. CO.*, New York, and will be stationed at the laboratories in Whittier, Calif. Formerly he was vice president and staff consulting engineer for Servel, Inc. *WILLIAM S. GOODFELLOW* has been appointed the company's general sales manager.

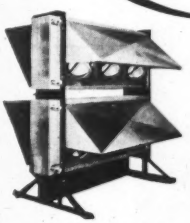
OTIS R. CARPENTER of the Barberton, Ohio works of *THE BABCOCK & WILCOX CO.*, New York, has been appointed executive assistant of the company. He joined the laboratory at Barberton in 1933, and was appointed director in 1947.


20 TON

40 TON


Cut out all **WATER** *problems*
WITH THE
UNICON* by **KRAMER**

The UNICON eliminates all water problems . . . because it does not require any water. Any size compressor, regardless of tonnage, can be air-cooled with the UNICON by KRAMER. Stands, hood, and wind deflectors are available for simplified outside mounting of this Remote-Type Air-Cooled Condenser.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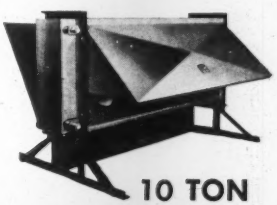
SPECIAL APPLICATIONS
Write to us about your condensing problem.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WRITE FOR
BULLETIN U-177-S
*PATENT-PENDING

KRAMER TRENTON CO.
Trenton 5, N.J.

Venting problems

meet their match

. . . when you install

TRANSITE INDUSTRIAL VENT PIPE

IF YOU HAVE a tough venting problem, the chances are good that you can solve it with Transite* Industrial Vent Pipe.

That's because this durable asbestos-cement product has proved in many installations that it can successfully resist many of the corrosive fumes, vapors, dusts and gases encountered in industrial venting operations. Its unusual chemical stability may help you realize important savings in plant maintenance . . . help you avoid frequent, costly replacements in your venting system.

Moreover, because Transite Industrial Vent Pipe is nonmetallic and therefore rustproof, it needs no painting or other protective treatment. Highly weather-resistant, it can be used for either indoor or outdoor service. A complete range of sizes up to 36" in diameter, with a complete line of rustproof, corrosion-resistant Transite fittings, adapts it to practically any job requirement. It is light in weight and can be readily cut and drilled with ordinary tools.

For further information address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto, Ontario. Ask for Data Sheet Series DS-336.

*Transite is a Johns-Manville registered trade mark

Typical Industries in which Transite Industrial Vent Pipe is used:

Aircraft	Foundry	Pulp & Paper
Automobile	Furnace	Quarrying
Baking	Furniture	Railroad
Bleaching	Gas	Rayon
Boiler Works	Glass	Refrigeration
Brewing	Laboratory	Rubber
Canning	Laundry	Shipbuilding
Ceramic	Leather	Shoe
Chemical	Match	Smelting
Dairy	Meat Packing	Soap
Drug	Metal	Soft Drink
Electrical	Mining	Sugar Refining
Explosives	Paint	Textile
Farm Machinery	Petroleum	Tool
Food	Potash	Water & Sewage

Johns-Manville

TRANSITE Industrial Vent PIPE

M. J. MURRAY, formerly general sales manager, Mt. Hawley Mfg. Co., has joined *SIEMON MFG. CO.*, Kansas City, Mo., as vice president and director of sales.

JOSEPH ASKIN has joined the engineering staff of *KRAMER TRENTON CO.*, Trenton, N.J. Formerly, he was chief engineer with the Techniflex Corp., Port Jervis, N.Y.

LEWIS W. CRAIGO has been appointed sales manager, *COMFORT PRODUCTS CORP.*, Dallas. He has an extensive background in radiation, air conditioning and heat transfer products.

FRED S. DUBIN & ASSOCIATES, consulting engineers, West Hartford, Conn., have announced the addition to the firm of *HAROLD L. MINDELL* as an associate. He was formerly with a midwestern firm of consulting architects and engineers.

ARTHUR MOODY, formerly with the Elliott Co., Jeannette, Pa., as chief engineer, Blower Div., has joined the product engineering department of *THE TRANE CO.*, La Crosse, Wis. He will work on the design and development of air conditioning and refrigeration products.

CLIFFORD C. McALEENAN has been appointed vice president in charge of sales, *CAPEWELL MFG. CO.*, Hartford, Conn. He came to the company in 1950, at the time it acquired V-Mac Industries, Inc., where he was sales manager and secretary treasurer. *SEERY C. GORDON* is now domestic sales manager. With the company for nine years, he is in charge of sales in the U. S. and Canada of the commercial line of products including pipe fitters' tools.

M. F. COTES, executive vice president of *MOTOR WHEEL CORP.*, Lansing, Mich., since 1947, has been elected president and general manager. He succeeds *JOHN E. GARLENT*, who is retiring under the corporation's retirement plan. Two new vice presidents elected are *KARL EGELER* and *D. F. JONES*, in charge of "Duo-Therm" sales and engineering, respectively.

J. F. STENGLEIN has been named sales manager, *CANTON STOKER CORP.*, Canton, Ohio. He formerly represented the company in Detroit. *J. C. FOSSELMAN*, former manager, Heating Div., Globe Machinery & Supply Co., Davenport, Ia., has joined him as assistant sales manager.

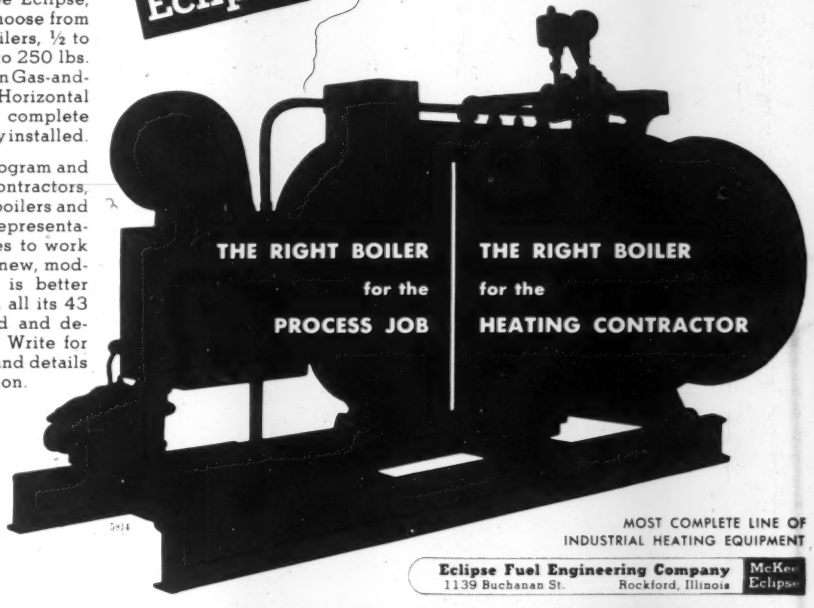
COMBUSTION CONTROL CORP., Cambridge, Mass., has appointed *BURTON E. SHAW* as vice president and general manager. Formerly he was vice president in charge of production and engineering.

G. H. NIEMYER was re-elected president at the recent annual meeting of *HANDY & HARMAN*, New York. *JUDSON C. TRAVIS*, executive vice president since 1950, was elected vice president and general manager, and was given the additional responsibility for all accounting and

McKee Eclipse **high pressure steam boilers**

When you sell McKee Eclipse, your customers can choose from a complete line of boilers, ½ to 100 H.P., pressure 15 to 250 lbs. Gas, Oil or Combination Gas-and-Oil Fired. Vertical or Horizontal "Steamboilerplants", complete package, easily, quickly installed.

Eclipse has a liberal program and policy for Heating Contractors, to help you sell more boilers and make more money; representatives in principal cities to work with you. In its brand new, modern building, Eclipse is better equipped than ever in all its 43 years, to design, build and deliver the right boilers. Write for descriptive bulletins, and details of contractor proposition.



MOST COMPLETE LINE OF INDUSTRIAL HEATING EQUIPMENT

Eclipse Fuel Engineering Company McKee Eclipse
1139 Buchanan St. Rockford, Illinois

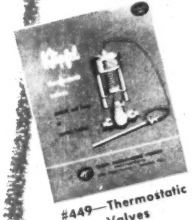
for temperature, pressure, liquid level control . . .

Choose Klipfel valves

#148—Reducing Valves

#349—Float Valves

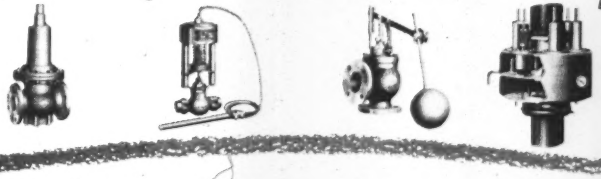
For dependability and economy . . . whether for plant equipment or manufactured products . . . specify Klipfel Valves . . . a wide range of standard types, as illustrated below, or controls designed specifically for you. If you have a control problem, discuss it with Klipfel Engineers. Write for the latest Klipfel Valve bulletins shown here, each contains valuable, easy-to-use selection and specifying data. Address Dept. S-1.



#449—Thermostatic Valves

#135M—Multiport Back Pressure Valves

Klipfel VALVES INCORPORATED
HAMILTON, OHIO



financial departments of the company. *FRANK C. JONES*, Bridgeport plant manager, was elected vice president in charge of production, and *THOMAS H. GALLAGHER*, managing director and treasurer of the company's Canadian subsidiary, was elected to the board of directors. All other officers and members of the board were re-elected.

Three executives of *ALUMINUM CO. OF AMERICA*, Pittsburgh, have been elected to newly created vice presidencies. *GORDON W. CAMERON*, treasurer since 1943, is now vice president and treasurer. *ARTHUR P. HALL*, director of public relations and advertising, becomes vice president in charge of these fields, and *C. F. NAGEL, JR.*, chief metallurgist, assumes the third new vice presidency.

SALVATORE GIORDANO, president, *FEDDERS-QUIGAN CORP.*, Maspeth, L. I., has been elected chairman of the board of directors. He will continue to serve as president, an office he has held since 1942.

ROBERT C. BECHERER, executive vice president and director, *LINK-BELT CO.*, Chicago, has been elected president, to succeed *GEORGE P. TORRENCE*, who has retired in accordance with the company's retirement plan.

JOHN H. CRANKSHAW has become associated with *J. A. ZURN MFG. CO.* and *AMERICAN FLEXIBLE COUPLING CO.*, Erie, Pa., as executive engineer, to operate in the field of product design and development. He had been associated with the General Electric Co., Erie Works, Locomotive Div.

WATTS REGULATOR CO., Lawrence, Mass., has appointed *BERNARD ALEXANDER*, formerly sales manager for Milwaukee Valve Co., as its sales manager.

W. R. WARREN LEISY is now chief chemist, *WHEATLAND TUBE CO.*, Philadelphia. He holds U. S. and British patents on zinc chromate, and has most recently been associated with the New Jersey Zinc Co., at Palmerton, Pa.

LEO F. THOMPSON is the new director of industrial relations, *THE LUNKENHEIMER CO.*, Cincinnati. He had been associate director of research, Parke, Davis & Co., Detroit.

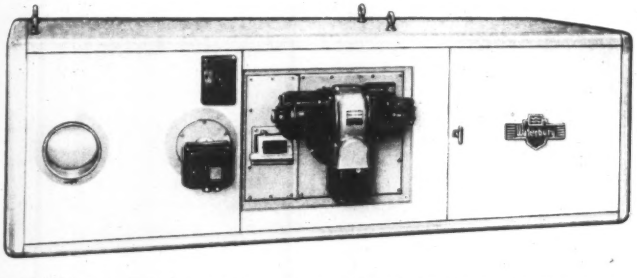
H. HARTMANN, vice president and general manager, Fresh'nd-Aire Co., Chicago, was recently elected chairman of the Dehumidifier Section, *NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION*.

. . . IN THE TERRITORIES

For *YORK CORP.*, York, Pa.—*WILLIAM T. HARRIS*, assistant to district commercial sales manager, southern district headquarters, Atlanta. He succeeds *A. H. JOHNSTON*, who resigned recently to become affiliated

FOR UNUSUAL INSTALLATIONS

A special unit is needed in situations where floor space is at a premium. This need has been met very successfully in the latest addition to the Waterbury line.



Waterbury

Oil-Fired, Forced Warm Air SUSPENDED FURNACE

4 Sizes: 84,000 to 168,000 B.T.U. Output

Commercial buildings, industrial plants, and certain types of homes require a warm air heating plant with the qualities of the Waterbury suspended furnace. A real space saver, it can be suspended in a crawl space under the floor, from the basement ceiling, in the attic, or in any portion of the building where more space is readily available at ceiling level than on the floor.

A "package" unit, assembled at the factory, the Waterbury suspended furnace has all parts accessible from the front, for easy inspection, cleaning and servicing. Air filters and a large capacity blower are standard equipment. This compact unit deserves serious consideration by owners, builders and men concerned with the maintenance of service stations and other commercial or industrial buildings.

Waterbury manufactures a complete line of furnaces and winter air conditioners, with a unit for every size home and every type of fuel.

The Waterman-Waterbury Co.

OVER 45 YEARS OF WARM AIR HEATING

1152 Jackson St., N.E., Minneapolis 13, Minn.

400 TONS • CAPACITY

PATENTED
DUO-PASS and
OILOUT

Aeropass CONDENSER

U. S. Patent Reissue No. 21,917; 22,553

YOU USE LESS POWER...
SAVE CONDENSER WATER...
SAVE UPKEEP COST

For large refrigeration systems, NIAGARA gives you a choice between a battery of condensers (that may be cut on or off with the load) or a high capacity condenser that saves space.

Both have the patented "Duo-Pass" and "Oilout" that remove superheat and keep the system free of oil. Results: you save one-third or more of power cost and upkeep expense. Niagara Patented Balanced Wet Bulb Control gives lowest head pressure operation automatically. *Write for Bulletin 111.*

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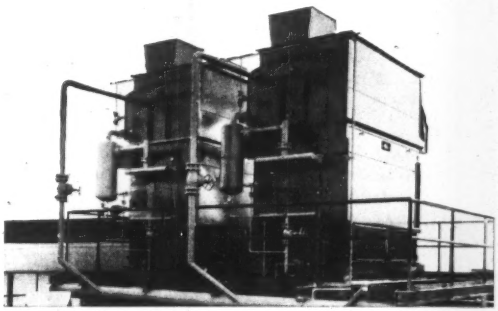
Over 35 Years Service in Industrial Air Engineering

Dept. HP, 405 Lexington Ave., New York 17, N. Y.

Field Engineers in Principal Cities of U. S. and Canada

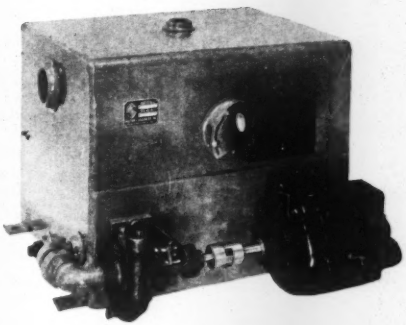


PUMP ? STUMPED

an

EAGAN PUMP

is the answer



"Illustrated above is the **Eagan "Eagle"** versatile unit, handling 8,000 sq. ft. at 20 P.S.I. and selling for a trade price of **$139.00** F.O.B. Philadelphia.

Eagan Standard Units are made in single and duplex models to 150,000 sq. ft. E.D.R. at pressures to 200 P.S.I.

Your pump problems are invited. Eagan engineers or your local Eagan representative of the factory engineers offer their services for any pump requirement."

Write Today

WALTER H. EAGAN CO., Inc. (Dept. B.)
2336-38 Fairmount Avenue
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YOU GET
REAL SERVICE
WITH
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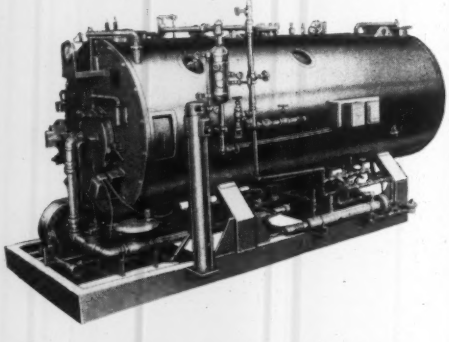
GENERATOR

Before Installing . . .
A Complete Manual
on "How To Do It"

After Installing . . .
Our LOCAL Service Man Starts
Unit and Provides Three
Months Free Service



Nineteen Sizes — 10 to 500 h.p.
15# to 200# w.p.
OIL or GAS

WRITE FOR BULLETIN 1050

AMES IRON WORKS
BOX G-6 OSWEGO, N. Y.
Builders of Better Boilers Since 1848

with Pittman-Singleton, Inc., a company distributor in Fayetteville, N.C. Mr. Harris' territory includes Georgia, Florida, South Carolina, North Carolina, Alabama, Tennessee and Kentucky.

For *CONOFLOW CORP.*, Philadelphia—*EQUIPMENT SALES CORP.*, 341-345 W. Market St., Kingsport, Tenn., representative for eastern and central Tennessee and southwestern Virginia.

For *THE TRANE CO.*, La Crosse, Wis.—a number of new representatives throughout the country: *WALTER T. RITTER*, with the Oklahoma City sales office; *LOY FRANK THOMPSON*, Greensboro, N.C., office; *ALLEN L. SMITH*, Columbus, Ohio, office; *GEORGE W. SHEPHERD*, New Orleans office; *WALTER LAMBERT, JR.*, Pittsburgh office; *JAMES GLEDHILL*, Newark, N.J., office; *MURRAY W. BINKLEY*, Detroit office.

For *JACKSON & CHURCH CO.*, Saginaw, Mich.—representatives in two reorganized districts: *PAUL DEUBLE*, for Ohio, Indiana, western Pennsylvania, Kentucky, and northwest West Virginia, headquarters at Oberlin, Ohio; *R. P. JONES*, for western Michigan, offices at 900 Monroe St. N.W., Grand Rapids.

For *DETROIT STOKER CO.*, Detroit—representative for Cleveland territory, *THE STEPHAN CO.*, 7016 Euclid Ave., Cleveland.

For *THE AMERICAN BRASS CO.*, Waterbury, Conn.—*SCOTT H. PATTERSON*, formerly New York City district sales manager, now branch manager at the Buffalo, N.Y., plant. He succeeds *JUSTICE LOCKWOOD*, now vice president in charge of sales.

For *KAYLO DIV., OWENS-ILLINOIS GLASS CO.*, Toledo—sales engineer, Chicago office, *SAM Q. DITTENHOEFER*, to handle heat insulation and insulating roof tile in Chicago and Milwaukee areas.

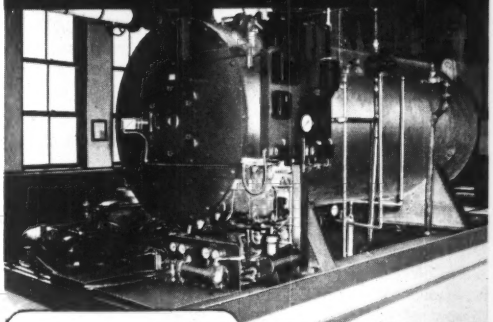
For *ALLIS-CHALMERS MFG. CO., GENERAL MACHINERY DIV.*, Milwaukee—*RANDALL F. BELLOWS* and *WALLACE E. BASCO*, sales representatives, Minneapolis and Chicago district offices, respectively.

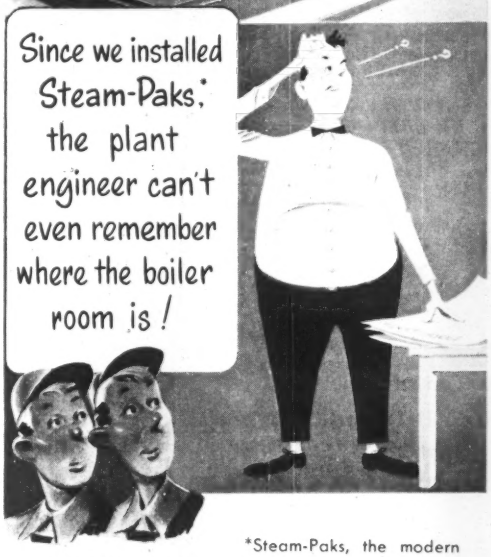
For *BARNES & JONES, INC.*, Boston—four new agents: *DOMER H. THIELE*, 217 E. Bruceton Rd., Pittsburgh 27, for Pittsburgh; *JOHN F. HANNAN, JR.*, P.O. Box 488, Silver Springs, Md., for Washington, D.C.; *WALTER A. STREATER*, 169 W. Peachtree Place, N.W., Atlanta 3, for Atlanta; *J. H. BALLENGER*, 1231 Bursal Ave., Cincinnati 30, for Cincinnati.

For *YORK-SHIPLEY, INC., INDUSTRIAL DIV.*, York, Pa.—*EMILE ESTOCLET*, regional manager for eight eastern states, now engaged in setting up new outlets for the company's industrial power equipment.

For *MINNEAPOLIS-HONEYWELL REGULATOR CO., INDUSTRIAL DIV.*, Minneapolis—sales manager,

$20,000 SAVED– This Steam-Pak generator installed in Stevens Linen Associates, Webster, Mass. saved $20,000 in operating during the first year of operation.





*Steam-Paks, the modern steam generators, operate automatically around-the-clock, furnishing steam or hot water as required. This automatic operation cuts costs, frees operator for other duties, and relieves the boiler "worries" of the plant engineer. Available in complete range of sizes from 15 to 300 hp. for high or low pressure steam or hot water. Fired with oil, gas, or a combination of oil and gas.

GET YOUR COPY OF THIS MANUAL TODAY

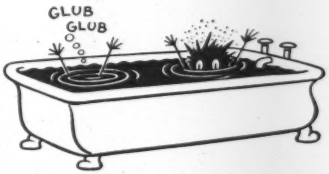
"Steam in a Package"—a 14 page book which tells the installation and operating advantages of York-Shipley Steam-Pak Generators. Write today for your free copy of Bulletin 201-D.

YORK-SHIPLEY, INC.
Industrial Division, York 8, Pa.
Automatic Heat and Power Specialists since 1918

AIR-MAZING FACTS

BY O. SOGLOW

SLEEPING VOLCANOES ARE WARMING WINTERS! Since 1912, volcanic eruptions have been declining, winter temperatures rising. Scientists see a connection. Fifty years ago, volcanic dust blocked up to 20% of the sun's rays; today this heat is getting through.



OIL BATH DROWNS DUST! Polished engine parts get a longer lease on life with an Air-Maze oil-bath filter on the air intake. Dirty air is scrubbed clean in a pool of oil. Dust can't get through to do its dirty work

DROWNS NOISY AIR! Air rushing through engine and compressor intakes often sets up a racket that makes employees jittery, annoys neighbors. Keep 'em happy by using Air-Maze filter silencers. They muffle the noise as well as filter the air

WHETHER YOU BUILD OR USE engines, compressors, air-conditioning and ventilating equipment, *or any device using air or liquids* —the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE
The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

eastern and mid-Atlantic regions, *JOHN A. ROBINSON*, succeeding *O. B. WILSON*, now field sales manager. For the midwest region, *JOSEPH J. MATULIS* is industrial manager, succeeding Mr. Robinson. *C. G. BEHNKE* is now industrial manager, Chicago branch office.

For *CANTON STOKER CORP.*, Canton, Ohio—additional representatives in a number of areas: *H. D. BAKER CO.*, Detroit; *TENNESSEE HEATING SALES*, Knoxville; *RUSSELL SMITH EQUIPMENT CO.*, Columbus, Ohio; *WM. KNIGHT ASSOCIATES*, Cincinnati; *HARRY ROPKE ASSOCIATES*, Louisville; *V. C. SNOWBERGER*, Indianapolis; *F. J. FALLQUIST CO.*, Spokane; *S. C. McCANN CO.*, Kansas City, Mo.; *ABGAR HEATING CO.*, Buffalo; *W. J. CONLEY CO.*, New York City; *E. C. SHOLLER*, Philadelphia; *H. WARING*, Greenville, S.C.; *FOWLER ENGINEERING CO.*, Milwaukee; *D. L. SANTCHI*, Toledo; *F. J. FUCHS*, Pittsburgh.

For *JOHN J. NESBITT, INC.*, Philadelphia—*EDWIN P. SHORT*, formerly associated with Thatcher Furnace Co., Garwood, N.J., now promoting convector-radiator sales in the Philadelphia and Wilmington, Del., areas.

For *BALTIMORE AIRCOIL CO., INC.*, Baltimore—*JOSEPH MILLER*, 11 Broadway, New York 4, exclusive export distributor (not including the Dominion of Canada) for evaporative condensers and cooling towers.

For *THE PATTERSON-KELLEY CO., INC.*, East Stroudsburg, Pa.—representative in Philadelphia area, *C. N. RINK CO.*, Ardmore, Pa., for air conditioning and refrigeration equipment. The Philadelphia office will continue to handle all other products in that area.

For *MANNING, MAXWELL & MOORE, INC.*, Stratford, Conn.—two new district managers: *RAYMOND C. WEST*, now gulf coast district manager, headquarters, Houston; and *GEORGE F. BRIGHT*, formerly a territorial salesman, succeeding Mr. West in his former post as mid-continent district manager, headquarters, Tulsa.

For *SUB-ZERO PRODUCTS DIV.*, Deepfreeze Distributing Corp., Cincinnati—new representatives: *THE GEORGE KELLER MACHINERY CO.*, 1807 Elmwood Ave., Buffalo, for western New York state, and *J. WALTER McCLOY*, 414 Reynolds Arcade Bldg., (associated with the Keller Co.) for Rochester, New York; *DIXIE MILL SUPPLY CO.*, Tchoupitoulas & St. Joseph St., New Orleans, for southern Louisiana, Alabama, and Mississippi; *CLEVELAND DUPLEX MACHINERY CO., INC.*, Penton Bldg., W. 3rd and Lakeside Aves., in eastern and northern Ohio.

For *GENERAL CONTROLS CO.*, Glendale, Calif.—*RUDY ROEDDER*, western manager, Refrigeration Controls Div. *GEORGE CROTHERS*, manager, new Toronto, Can., branch office, in the Commonwealth Bldg.

For *CLEAVER-BROOKS CO.*, Milwaukee—*DYKE & TUTSCH CO.*, 3253 N. Green Bay Ave., Milwaukee 12,

QUICK PROFITS . . . EASY INSTALLATIONS . . . SATISFIED CUSTOMERS

when you go after

REPLACEMENTS and CONVERSIONS

with

BANKHEAT BURNERS

Now is the time to replace oil wasting burners with a Bankheat. It's the easiest selling that you can do today . . . selling that will make you a profit, and a new set of satisfied customers.

Bankheat Burners have an unequalled reputation for oil-saving efficiency. In thousands of homes they are powering boilers, boiler burner units and water heaters. For many years in many lands they have been building up a record of economical performance. They're fully automatic, precision built, easy to install, exceptionally dependable. They are today's best bet for dealers who want sales. May we send you the full story?

There's an automatic Johnson Burner for EVERY heating need.

Johnson Oil Burners

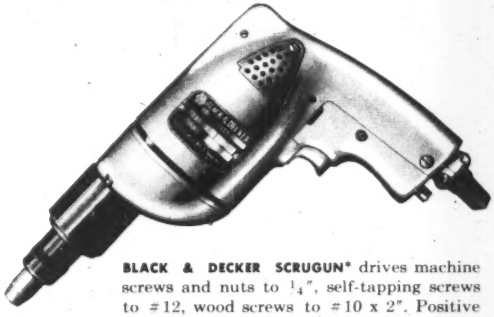
Builders of fine Oil Burner Equipment since 1903

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
401 No. Broad St., Philadelphia 8, Pa.

Speed up Assembly!

Switch to BLACK & DECKER POWER!

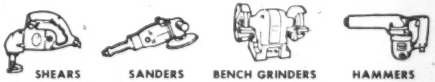
BLACK & DECKER HOLGUN* drills holes to $\frac{1}{4}$" diam. in steel, to $\frac{1}{2}$" diam. in hardwood. Perfectly balanced, light in weight, compact, easy to handle, accurate. Famous "Pistol Grip and Trigger Switch."



BLACK & DECKER SCRUGUN* drives machine screws and nuts to $\frac{1}{4}$", self-tapping screws to #12, wood screws to #10 x 2". Positive or adjustable clutch available. Same design features as B&D HOLGUN!

SEE YOUR NEARBY B&D DISTRIBUTOR for demonstrations and full details on this famous team of assembly tools. They'll help your men turn out more work, with less fatigue and less spoilage. And you have nearly 50 other B&D Drill and Screw Driver models to choose from to fit your needs on heavier work! Write for free catalog to: THE BLACK & DECKER MFG. Co., 628 Pennsylvania Ave., Towson 4, Md.

*Trade Mark Reg. U. S. Pat. Off.



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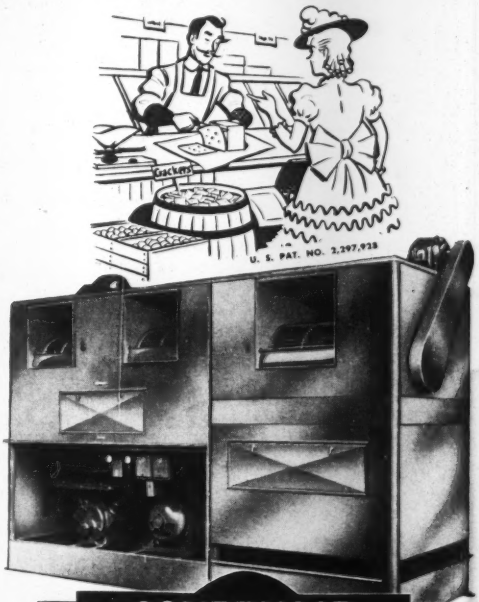
Packaging has improved lots of things



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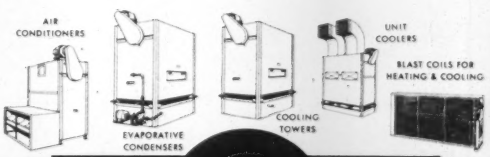
ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

Packaging makes many products more efficient, more convenient and more acceptable these days. And large size packaged air conditioners (up to 60 tons) are no exception!

That's why *so many* Governair Completely Packaged Air Conditioners are in use today. They are engineered and built by the pioneers of large size packaged air conditioning — *Governair!*

If you want a package deal that will do a better job of air conditioning for you choose Governair! Sized from 3 to 60 tons. GOVERNAIR CORPORATION, 513 N. Blackwelder, Oklahoma City, Okla.



GOVERNAIR

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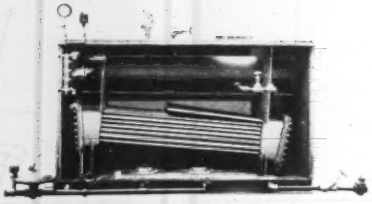
FULL STEAM AHEAD...



MUND BOILERS READY TO BE SHIPPED ANYWHERE...TODAY

Eliminate costly shut-downs, untimely delays. The vital steam power you need *today* can be shipped *today*! From strategically located, factory-equipped warehouses, MUND packaged-steam boilers are ready for shipment in a matter of hours. And MUND factory-trained service-jobbers assure quick installation and continuous operating efficiency.

Keep your plant going *full steam ahead*. Trust MUND Boilers to deliver constant, uniform power. Efficient, compact, inclined water tube design provides many years of trouble-free service. Sizes 1½ to 350 H.P. Gas, oil or combination burners. A.S.M.E. approved. *Ready to be shipped anywhere TODAY.*

WRITE, PHONE, WIRE FOR SERVICE-JOBBER NEAREST YOU!

MUND Boilers, Inc.

1600 N. Indiana St., Los Angeles 63, Calif.

representative for boiler equipment in nine counties in southeastern Wisconsin, including Milwaukee, Racine, Kenosha and Waukesha counties. *R. J. TUTSCH* was formerly sales manager of the company's Boiler Div., and *T. P. DYKE* was a division city sales engineer.

For *INTERNATIONAL HEATER CO.*, Utica, N.Y.—sales representative to handle complete line of boilers and furnaces in eastern Ohio, western Pennsylvania, and West Virginia. *E. J. HOPPE*, formerly sales manager, Keokuk Gas Service Co. *NEWVILLE HEATING SUPPLY INC.*, 1211 E. Eleven Mile Rd., Royal Oak, Mich., will distribute products in the Detroit area.

For *YOUNGSTOWN SHEET AND TUBE CO.*, Youngstown, Ohio—*PERRY G. SNYDER*, formerly chief engineer, Aetna Standard Engineering Co., now district engineer, Youngstown district, to succeed the late *RAY FENTON*.

For *UNISTRUT PRODUCTS CO.*, Chicago—eastern district manager, *CORNELIUS ELSASSER, JR.*, headquarters at Unistrut Eastern Service Co., 71 Woolsey St., Irvington, N.J.

For *HARVEY-WHIPPLE, INC.*, Springfield, Mass.—*LOWELL B. MEINERZ*, for two years "Master Kraft" representative in Wisconsin and Minnesota, now transferred to cover eastern New York State.

For *BUSH MFG. CO.*, West Hartford, Conn., and *HEAT-X-CHANGER CO.*, Brewster, N. Y.—*CARL GAEBEL*, representative in southern Illinois, western Kentucky, Missouri, and Kansas, headquarters, St. Louis. New sales engineers for the two companies are: *R. A. MALARKEY*, for southern New Jersey, eastern Pennsylvania and Delaware, headquarters, Philadelphia; and *R. M. CARBERRY*, for the Dayton, Ohio, area, including Columbus and Cincinnati, as well as parts of Indiana, Kentucky and West Virginia, headquarters, Dayton.

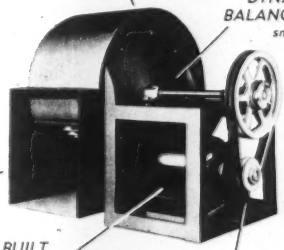
For *THE BLACK & DECKER MFG. CO.*, Towson, Md.—six new district sales managers: *E. M. STUART*, northeastern region; *A. LEE PROCTOR*, southeastern; *RAYMOND G. HORNER*, central; *W. L. POYNTER*, midwest; *ARTHUR S. BOEHM*, Pacific coast; and *DONALD S. McKERACHER*, Canada.

For *DRAVO CORP.*, Pittsburgh — new office at 1110 S. Brentwood Blvd., St. Louis 17. Sales engineer is *FRED W. SCHULTE*.

For *OWENS-CORNING FIBERGLAS CORP.*, Toledo — two new branch offices. The Tampa, Fla., office covers Camden and Charlton counties in Georgia, and all of Florida, except areas west of Liberty and Franklin counties. The New Orleans office serves southern Louisiana, southwestern Alabama, southern Mississippi and southwestern Florida, including Pensacola. *A. C. WILSON*, with the company since 1938, is manager at Tampa, and *WALTER W. A. BODEN*, with the firm since 1942, is manager in New Orleans.

ENGINEERED PERFORMANCE

with PEERLESS FANS and BLOWERS



Certified Ratings — AMCA — FMA

Smoothest Performer
ON THE MARKET

You get better service at lowered cost when you specify Peerless Electric Fans and Blowers.

Built to your exact requirements on rugged all-welded frames with job-matched Peerless Motors, Peerless Fans and Blowers are guaranteed to move more air faster with less turbulence. Write today for free catalog showing complete Peerless line and see for yourself what more than 59 years of experienced craftsmanship means to you.

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- DIRECT DRIVE EXHAUST FANS
- UTILITY BLOWERS
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THE PEERLESS ELECTRIC COMPANY
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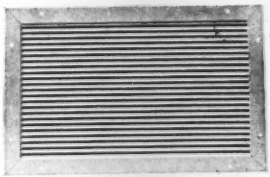
Peerless Electric
FAN AND BLOWER DIVISION

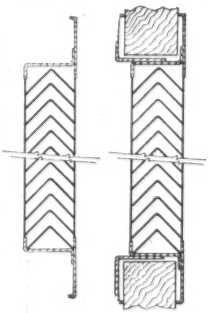
Save Dollars and Days
On Every Job... with "A-J"s!



A-J

NO-VISION DOOR AND PARTITION GRILLES

AUXILIARY FRAMES FOR *NEAT* — *FAST* — *EASY* INSTALLATION!



This exclusive feature can save you hours on every job! Ends tedious fitting. Special telescoping frame slides over core of grille. Automatically adjusts to fit any door thickness from 1⅜" to 2½". Gives same neat appearance on both sides.

These famous A-J Grilles are designed to save you time and money on every job. Series 700 (illustrated) Grilles are made entirely from steel. Special inverted "V" shaped louvers are securely set into end frames on ½" centers. Metal corners are re-inforced with a metal backing, and spot welded.

A-J Grilles are completely sight-proof from either side, yet allow a maximum circulation of air. They are widely used for exhaust and return air grilles where horizontal, downward deflection is desired.

A-J Grilles are available in a wide range of sizes from 6" x 4" to 60" x 24", as well as special sizes required to fit any job. Grilles are finished in your choice of a variety of finishes: prime, Japan, baked enamel or lacquer.

Find Out Today How A-J Can Save You Time and Money . . . . .

WRITE FOR OUR COMPLETE, ILLUSTRATED CATALOG

Listing Over a Thousand Types and Sizes of Grilles For Every Requirement.

A-J MANUFACTURING CO.

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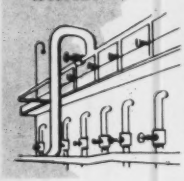
NERVA-PLAST

COLD SETTING CEMENT

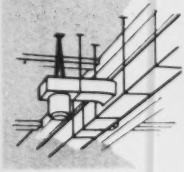
a completely waterproof, weatherproof, corrosion-resistant, flexible, applied coating

KEEPS INSULATION INTACT



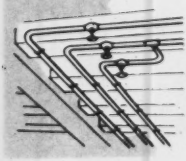
Prevents deterioration of porous heat insulating materials and pipe covering on outside lines and equipment above and below ground.

PROTECTS DUCTS AGAINST INSIDE CORROSION



When applied directly to inside of ducts, Nerva-Plast forms a protective coating against condensation, corrosive gases and moisture.

PREVENTS CONDENSATION



. . . where applied directly on cold water lines in textile and other industrial plants requiring a high degree of humidification.

Resists effectively the deleterious action of acids, alkalies, Portland cement, and sub-zero temperatures

•

Bonds readily and efficiently to all types of heat insulation materials, metals, asphalted felts and concrete

•

Nerva-Plast is easily and economically applied. Can be brushed, sprayed or trowelled on. Will take aluminum paint easily.

Mail coupon for additional information

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Please send me information on Nerva-Plast for use on .....

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Company.....

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NEW BOOKS & REPORTS

Heat Power

Elementary Heat Power (second edition) has been prepared as a text to be used in a first course in heat power, preceding a thorough course in engineering thermodynamics, or in a terminal course for non-mechanical engineering students. The authors, H. L. Solberg, O. C. Cromer, and A. L. Spalding (all of the faculty of Purdue University) have expanded this edition by about 100 pages, principally to include a discussion of the general energy equation of the steady flow process and its application to power plant equipment, and a more complete discussion of engineering units and dimensions.

Chapters cover matter and energy; fuels and combustion; internal combustion engines; fuel burning equipment; steam generation; pumps; drafts, fans, blowers, and compressors; feed water heaters and condensers; and other topics.

This 624 page book is available from the publisher, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, at $6.50 a copy.

Engineering Thermodynamics

Since the appearance, in 1937, of the first edition of *Engineering Thermodynamics*, by Newton C. Ebaugh, far reaching advances have been made both in fundamental data relating to thermodynamics, and its application to modern industrial equipment, largely as the result of intensive scientific effort during World War II. These developments have been incorporated in the second edition of the book, just issued.

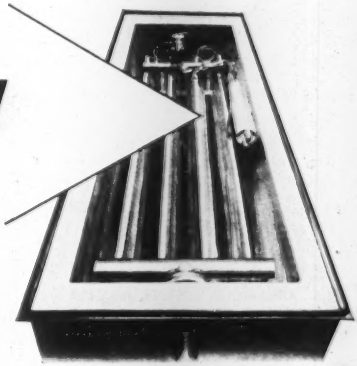
The book is arranged primarily as a text for students who have studied general physics, inorganic chemistry, and mathematics through the calculus. The first eight chapters cover fundamental data (thermodynamics and energy, energy equations, entropy, vapor properties and processes, etc.). Subsequent chapters deal with flow of fluids, steam engines, gas power cycles, refrigeration cycles, flow of heat, and other fields of application.

This 398 page book is available from the publisher, D. Van Nostrand Co., Inc., (College Dept.), 250 Fourth Ave., New York 3, at $5.75 a copy.

Air Pollution Control

Natural conditions which prevent the escape of smog have existed in the Los Angeles area for many years, but only during the last ten has the great concentration of population and industry produced such quantities of pollution that existing natural "trapping" mechanisms have made smog a serious problem. Towards the understanding of this problem, and its control, the Los Angeles County Air Pollution Control District has issued the *Second Technical and Administrative Report on Air Pollution Control in Los Angeles County*, 1950-1951. The 51 page report discusses the causes and control of smog, and analyzes the Los Angeles atmosphere, the chemical and physical properties of Los Angeles smog, total daily emissions to the Los Angeles atmosphere, and effects of the smog on vegetation.

Install . . .
YOUR AIR CONDITIONING *NOW!*



NOW—before unbearable summer heat drives trade away and slows down employee production—give your customers the benefits of comfort cooling. It's easy and economical with DOLE Ice-Cels. You don't have to tear into walls and ceilings to install cumbersome ducts; no unsightly cooling towers to be erected on the roof. DOLE Ice-Cels can be placed in any out-of-the-way spot with a compressor, and the chilled water circulated through small tubing to all areas to be air conditioned. Forced air diffusers, controlled by thermostats, will provide comfortable, effective cooling day and night.

Ask for Ice-Cel Engineering Catalog.

NEW . . . We couldn't improve the Ice-Cel but we have made automatic the control of ice thickness with the new Electronic Ice Control. Always on the job . . never forgets to remember. Ask for data sheet on this new device.

DOLE REFRIGERATING COMPANY — 25th Anniversary — 1927-1952

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MEETINGS & CONVENTIONS

IBR SCHOOL OF MODERN HEATING — June 10 to 12, Binghamton, N.Y.; June 17 to 19, Newark, N.J.; June 24 to 26, Hartford, Conn. Sponsored by The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17. The school is a three day course providing instruction in the design and installation of hot water and steam heating systems.

HEATING, PIPING & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, Suite 1401, Rockefeller Center, 1250 Avenue of the Americas, New York 20 — 63rd annual convention, June 10 to 13, Hotel Statler, Boston.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 29 W. 39th St., New York 18 — Semi-annual meeting, June 15 to 19, Hotel Sheraton-Gibson, Cincinnati. Among papers to be read at the first fuels session (June 16, 9:30) is:

Proper Design-Installation-Application of Coal Burning Equipment for Boilers 125-500 hp) to Prevent Smoke and Air Pollution — The Solution, by H. C. Ballman

Papers to be presented at the session on effect of temperature on metals (June 16, 8:00 p.m.) are:

Operating Experiences on the Mechanical Joint Connecting Austenitic-Ferritic Materials in the Main Steam Line at Ridgeland Station, by E. C. Bailey, H. C. Schroeder and I. Carlson

Comparison at Elevated Temperatures of Some Commercial Grades of Ferritic Cast Steels, by H. W. Wyatt, J. W. Bolton, and M. L. Steinbuch

Papers to be presented at the second heat transfer and third power session (June 18, 2:30 p.m.) are:

Performance of Finned Tubes in Shell-and-Tube Heat Exchangers, by D. L. Katz and R. B. Williams

Local Coefficients of Mass Transfer by Evaporation of Water into an Air Jet, by M. Spielman and M. Jakob

Cooling Tower Characteristics as Determined by the Unit Volume Coefficient, by D. R. Baker and L. T. Mart

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Semi-annual meeting, June 16 to 18, The Essex and Sussex, Spring Lake, N.J. For details see page 133.

STOKER MANUFACTURERS' ASSOCIATION, 307 N. Michigan Ave., Chicago 1—1952 annual meeting, June 23 and 24, South Shore Inn, Lake Wawasee, near Syracuse, Ind. There will be committee meetings, June 22.

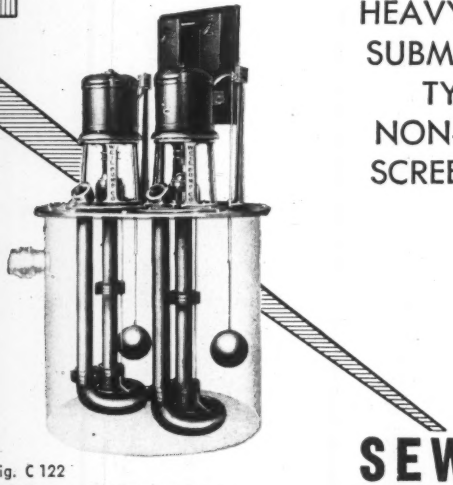
AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—50th anniversary meeting, June 23 to 27, Hotels Statler and New Yorker, New York. 30 technical sessions are scheduled, among them one on metals at elevated temperatures (June 23), one on continuous water analysis (June 24), and on conditioning and weathering (June 24). At the latter, one of the papers presented will be *Laboratory Air Conditioning*, by A. E. Stacey, Jr.

The date of the society's 1953 annual meeting, to be held at the Chalfonte-Haddon Hall, Atlantic City, N.J., is now set at June 29 to July 3.

Weil DEPENDABLE

weil Dependable PUMPS

HEAVY DUTY
SUBMERGED
TYPE
NON-CLOG
SCREENLESS



For LIQUIDS plus SOLIDS. Single or Duplex Types. Package units for residences and summer camps. Special Heavy Pumps for canning plants. Send for Bulletin C-900-D.

Fig. C 122

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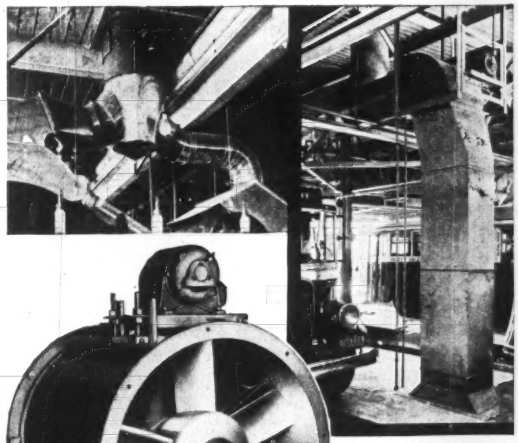
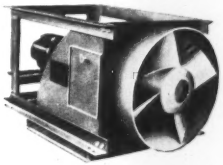
with a PROVEN Building Trades Sales Policy



Upper left: Wingfoil Straight-Line Duct Fan in Textile Mill. Upper right: Wingfoil Elbow Type Duct Fan exhausting gases in a Garage.

Wingfoil Straight-Line Duct Fan

Wingfoil Elbow Type Duct Fan



WINGFOIL DUCT FANS DELIVER LARGE AIR VOLUMES with Low Power Consumption . . .

The Wingfoil Axial Flow Duct Fan, in either elbow type or straight line type, is a compact, economical fan designed to operate against static pressure. Both types have the motor outside the casing, unaffected by hot or dirty gases. Light weight, compact, easily handled, they may be inserted into a line of duct, either as an elbow or a straight section.

Write for Bulletin F-10

L. J. Wing Mfg. Co. 140 Vreeland Mills Rd. Linden, New Jersey

Factories: Linden, N. J., Montreal, Canada

Wing AXIAL FLOW DUCT FANS

WEBSTER KINETIC* BURNER

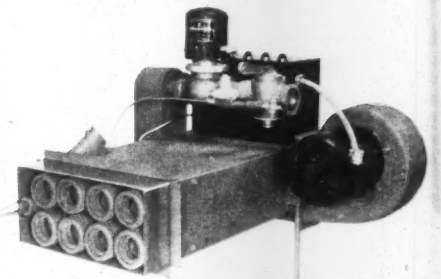
For Low Pressure Gas

The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

WEBSTER DYNETIC*

Forced Draft GAS BURNER



The WEBSTER DYNETIC Gas Burner consists of multiple venturi tubes with heat resistant alloy, flame retention nozzles assembled in a metal housing and equipped with an electrically driven blower to furnish all of the air for combustion.

All of the valves and controls required for safe, automatic operation, except for thermostat and limit controls, are incorporated in the assembly and wired and tested at the factory. The motor driving the blower is equipped with a centrifugal switch to prevent main gas valve operation unless the blower is functioning.

The burner is available in six sizes for natural gas.

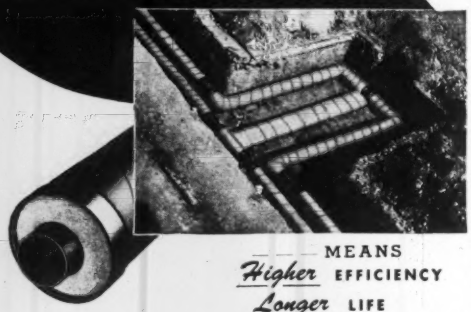
*TRADEMARK

The WEBSTER ENGINEERING COMPANY

TULSA, OKLAHOMA

Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

RIC-WIL
QUALITY INSULATED PIPING



MEANS
Higher EFFICIENCY
Longer LIFE
Lower INSTALLATION COSTS

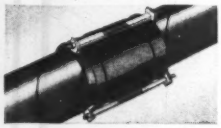
There is no stronger proof of Ric-wiL quality and dependability than the specification time after time of Ric-wiL Systems for heating and process distribution piping in major defense projects, industrial plants, and utility central heating systems.

Engineers like the way Ric-wiL Insulated Piping can be quickly adapted and laid out to meet any design or operating conditions. Contractors like the savings in installation possible with these 21-ft. prefabricated units, their easy handling and simple coupling features. Owners have the satisfaction of knowing that a Ric-wiL distribution system will provide high thermal efficiency, maximum protection, and long service life.

Condensate return piping and other lines subject to corrosive service may be coated with Ricwilite, a baked-on phenolic resin having outstanding corrosion resistance and durability.

Let a thoroughly experienced representative show you the installation and operating economies possible with Ric-wiL on your next insulated piping project.

RIC-WIL TYPE "B" COUPLER



Provides a watertight conduit joint with synthetic rubber gaskets. No conduit welding required, expediting joint closures.

WRITE FOR . . . Your copy of Section 480-6. Contains valuable data on pipe selection, flexibility, and expansion.

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INSULATED PIPING SYSTEMS
UNDERGROUND OR OVERHEAD

THE RIC-WIL COMPANY • CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES
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PREFABRICATED INSULATED PIPING

SECTIONAL CONDUIT SYSTEMS

PREFABRICATED MANHOLES

UTILIDOR TYPE CONDUITS

INSTRUMENT SOCIETY OF AMERICA, 1319 Allegheny Ave., Pittsburgh 33 — Seventh national instrument conference and exhibit, September 8 to 12, Cleveland. The eighth national conference and exhibit will be held September 21 to 25, 1953, Chicago, and the first international instrument congress and exhibit will be held September 14 to 24, 1954, in conjunction with the ninth national conference and exhibit.

SEVENTH NATIONAL CHEMICAL EXPOSITION— September 9 to 13, Coliseum, Chicago. Sponsored by the Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1.

AMERICAN INSTITUTE OF WHOLESALE PLUMBING AND HEATING SUPPLY ASSOCIATIONS, INC.— First national convention, October 19 to 22, Chalfonte-Haddon Hall Hotel, Atlantic City, N.J. For further information write G. T. Underwood, executive secretary, Room 102, Albee Bldg., 15th and G Sts., Washington, D.C.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17 — 34th annual convention, October 27 to 30, Atlantic City, N.J. An exhibit by the Gas Appliance Manufacturers Association will be held concurrently. The 35th annual convention will be held the week of October 26, 1953, in St. Louis.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18 — 38th annual meeting, November 30 to December 3, Hotel Commodore, New York.

REFRIGERATION EQUIPMENT MANUFACTURERS ASSOCIATION, 1346 Connecticut Ave., Washington 6, D.C. 10th all-industry refrigeration and air conditioning educational conference, December 5 to 7, Miami, Fla. (exhibits to be in the Miami Municipal auditorium).

11th INTERNATIONAL HEATING & VENTILATING EXPOSITION — THE AIR CONDITIONING EXPOSITION — January 26 to 30, 1953, International Amphitheatre, Chicago. Held under the auspices of The American Society of Heating and Ventilating Engineers. Address inquiries to the exposition management, International Exposition Co., Inc., Grand Central Palace, New York 17.

FIRE RESISTANCE OF SHUTTERS FOR MOVING-STAIRWAY OPENINGS, a report by Noland D. Mitchell, Edward D. Bender and James V. Ryan, presents the results of one exploratory and two full scale fire endurance tests on flexible rolling shutters for closing moving-stairway openings. The conclusion is that any design must make adequate provision for thermal expansion, equal or unequal, avoid undue distortions, and must retain the necessary structural stability of the device if it is to be satisfactory.

This 9 page report (U. S. Dept. of Commerce, National Bureau of Standards, Building Materials and Structures Report 129) may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 10 cents a copy.

MITCHELL 81—1

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No doubt about it—Penn Dynafans increase employee efficiency in your customer's plants by exhausting the "hot spots." This rugged unit can be depended upon to handle the toughest ventilation problems . . .

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- Sizes range from 250 c.f.m. to 30,000 c.f.m.
- Pulling power is positive and units will not overload regardless of resistance.
- Units are quiet running and have a low clean silhouette.

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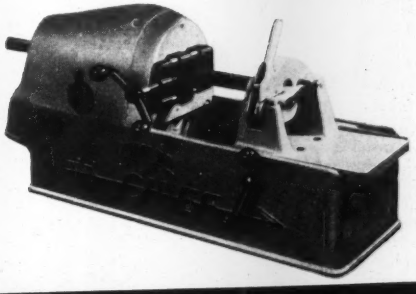
can your present pipe threading method match these QUIJADA CHIEF threading, reaming, cut-off speeds?



PIPE SIZE	½"	1"	1½"	2"
THREADING TIME	11 sec.	17 sec.	20 sec.	23 sec.
REAMING TIME	YOU REAM WHILE YOU CUT			
CUTTING TIME	5 sec.	5 sec.	7 sec.	9 sec.
TOTAL TIME	16 sec.	22 sec.	27 sec.	32 sec.

CHIEF POWER DRIVEN PIPE AND BOLT THREADER DOES IT FASTER...BETTER!

Now you can increase your production with actually less effort on the part of operators. You'll find all Quijada features lead to trouble-free, faster production on every job. It's easily portable too... weighs only 190 pounds fully equipped. You can take it anywhere there is power.

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VELOMETER
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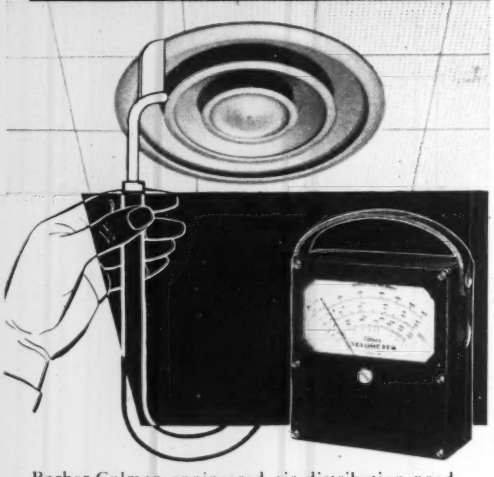
for
Precision Air-Flow Readings



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Proper installation is the all-important final step that assures uniform air distribution equal to design performance.

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The Velometer is the *only* instantaneous, direct-reading air velocity meter—accurate in all ranges, from high to low—compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all velocity measurement.

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Air Cooling Units

HPAC 101—Bulletin 185-F describes and illustrates typical applications of air cooling units for use with ammonia or brine refrigeration — Frick Co., Waynesboro, Pa. Applications include cold storages, meat processing rooms, ice cream plants, low temperature work, etc.

Air Moving Equipment

HPAC 102—Third edition (1952) of the 200 page manual, *How to Have Comfort from Moving Air*, covers more than 150 types of air moving equipment — The Torrington Mfg. Co., Torrington, Conn. Cooling and ventilating equipment covered includes roof ventilators, room air conditioners, evaporative air coolers, etc. Heating equipment includes central heating systems, unit heaters, oil burners, etc. Specifications and other data follow more than a score of brief discussions on specific air moving classifications. There is an index to manufacturers, all of whom use the company's air impellers for the products listed.

Air Power Squaring Shears

HPAC 103—Bulletin 87-A (four pages) deals with construction, new features, specifications and operation of air powered squaring shears of all-steel construction — Niagara Machine and Tool Works, 637-697 Northland Ave., Buffalo 11.

Alternators for Starting Pumps, Compressors, etc.

HPAC 104—Bulletin 7100 covers "Autocon" alternators for automatically transposing the starting sequence of any two pumps, compressors, blowers, burners, or units controlled by magnetic starters or two wire circuits — Automatic Control Co., St. Paul 1. They also provide standby protection against a failure of the operating equipment, of the pilot device, or of the alternator unit itself.

Anti-Rust Paints

HPAC 105—Bulletin L-1285 gives information on the selection and use of anti-rust paints for all metal surfaces — Paint Corp. of America, Fidelity Bldg., Cleveland 14. Chemical properties and methods of application are discussed.

Asphalt, Asbestos or Magnesia Products

HPAC 106—Reference manual, now in its second printing, contains a complete listing of 800 building materials and industrial products obtained from asbestos, asphalt or magnesia — The Philip Carey Mfg. Co., Dept. FRM, Cincinnati 15. Insulations and ducts are among the products covered. Army, Navy, ASTM, and other specifications

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- *Residential*
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Especially designed to supply hot water requirements for heavy and peak intermittant demands. These water heaters, or converters supply hot water to radiant heating panels or hot water systems. Live or exhaust steam in the converters' shells heats the water flowing through the tubes. They are designed for a working pressure of 150 lbs. per sq. in.

There's a wide range of sizes and capacities for every water heating need.

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Fully describe your requirements when you write—your inquiry will receive prompt and courteous attention. Bulletin 780 is yours on request.

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CAPACITIES 70,000 TO 20,000,000 BTU INPUT

Regardless of the size of the heating plant, Lo-BLAST Gas Burners deliver more heat per fuel dollar. In 19 years of actual operation, these power-type units have consistently cut fuel and service costs.

Because primary and secondary air is perfectly controlled from a blower source, the Lo-BLAST Burner is independent of variable natural draft. Hence it is particularly well suited for downdraft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to crown sheet as well as side walls.

Other features include soft, quiet flame . . . standard controls with positive acting pilot and blower safetys . . . sturdy, fool-proof design . . . easy to install because completely assembled and factory-tested on gas . . . competitively priced.

A Lo-BLAST dealership is profitable! Complete range of capacities and a nation-wide reputation for economy make this burner a strong seller. Write for information.

The standard Lo-BLAST Gas Conversion Burner

MID-CONTINENT METAL PRODUCTS CO.
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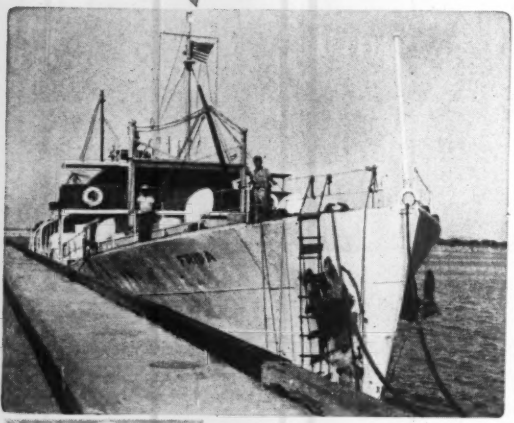
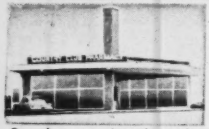
THEY SAY:
"There's nothing like this Air Conditioning"

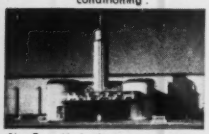




One of many modern pharmacies that depend on Ready-Power.

More and more super markets are using Ready-Power.

Ready-Power is ideal for church air conditioning.



The Casa Linda theatre saves many dollars with Ready-Power.

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Wherever used, Ready-Power has met the test of operating efficiency to the full satisfaction of the user.

Ready-Power air conditioning equipment is planned and designed to meet the most exacting requirements with the lowest possible operating costs.

Ready-Power design permits *continuous* operation at varying speeds, which is far superior to "on and off" types. This means that the air conditioning system performs at reduced capacity allowing for a constant dehumidification of the fresh air supply.

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Manufacturers of Gas and Diesel Engine-Driven Generators and Air Conditioning Units; Gas and Diesel-Electric Power Units for Industrial Trucks

are given, with their corresponding product. All information is cross indexed.

Cab Coolers and Conditioners

HPAC 107—Bulletin 1301 (24 pages) describes a complete line of cab coolers and conditioners — Dravo Corp., Air Conditioning and Combustion Dept., Dravo Bldg., 5th and Liberty Aves., Pittsburgh 22. Complete specifications and application information are included.

Centrifugal Cast Tubing

HPAC 108—Engineering Memorandum No. 11 covers the characteristics, properties, analyses, applications and other pertinent facts on "Acipco" (American Cast Iron Pipe Co.) centrifugal cast tubing — Peter A. Frasse & Co., Inc., 17 Grand St., New York 13. Sizes range from 2 to 50 in. OD, with wall thickness from ¼ to 4 in. Specifications and application information are given.

Centrifugal Pump

HPAC 109—Specification folder describes the new Model P-104 all-purpose completely submersible, hermetically sealed centrifugal pump, particularly suited for coolant applications in industrial plants — Kenco, Inc., 1125 North Ridge Rd., Lorain, Ohio. The pump will handle a variety of liquids. Maximum pump capacity is given as 1000 gal at zero head with a maximum head of 9 ft.

Controllers for Industrial Processes

HPAC 110—Bulletin 461 covers eight types of the Model 40 controller for industrial process applications — The Foxboro Co., 26 Neponset Ave., Foxboro, Mass. Single action, dual, duplex, auto-selector, ratio, relation, pneumatic set and time schedule types are described, for control of temperature, pressure, flow, pH, conductivity and other process variables.

Cylinder-Finish Tubing

HPAC 111—Bulletin R-7 covers "Rockrite" cylinder-finish tubing with improved tolerances for hydraulic and pneumatic cylinders, designed to permit standardization and savings in total cost of finished mechanism — Tube Reducing Corp., Wallington, N.J.

Electric Controls

HPAC 112—Bulletin GEA-5781 is a selection guide for a wide range of electric and electronic controls, devices and accessories — General Electric Co., Schenectady 5, N.Y. It contains listings of additional publications which give complete information on each item. Covered are motor starters, relays, float switches, pressure governors, and other products.

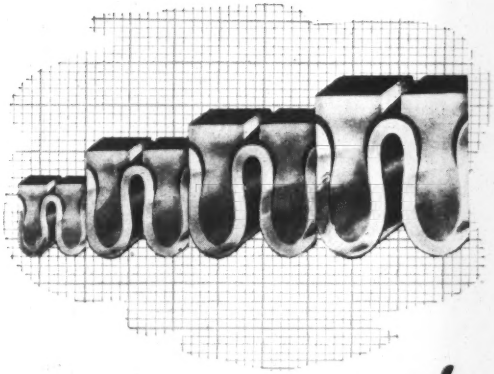
Electrode Holder

HPAC 113—Form CP-51 gives particulars on the Model A-732 electrode holder (300 amp) — Tweco Products Co., P.O. Box 666, Wichita 1. It utilizes a high copper alloy for maximum conductivity, and handles 7/32 through 1/16 in. electrodes.

Equipment for Air Handling, Cleaning and Conditioning

HPAC 114—Catalog 600 (56 pages) covers general purpose, industrial, and heavy duty fans; heat transfer products; air conditioning equipment; and electronic air cleaners — Westinghouse Electric Corp., Sturtevant Div.,

Designed and engineered



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Experience has proven that longer expansion joint life can only be safely assured by varying the depth of corrugation with relation to size and traverse per corrugation. In the regular practice of precision manufacture and engineering Badger Manufacturing Company has established standards for different diameters. *Not just a shallow and a deep corrugation, but precisely the accurate depth of corrugation needed.* Just one of the many important characteristics and reasons you should specify Badger Expansion Joints.

D-F S-E Directed-Flexing Self-Equalizing: an exclusive feature of Badger Expansion Joints. The flexing of the corrugations is progressively directed over each segment of each of the all-curve corrugations by correspondingly shaped self-equalizing rings. Localized stresses are eliminated insuring a more flexible longer lasting joint.

Buy Badger Joints and you get flexibility. D-F S-E and these features:

- Packless . . . pressure-tight single-tube — requires no maintenance
- Compact . . . approximately the size of flanged fitting
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- Wide range of traverse — pressure — temperature

Fabricated from deoxidized copper, stainless steel and special alloys to meet various operating conditions.

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Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

Five of the Clarage Heavy Duty Fans in the air conditioning systems of The Upjohn Company's new plant in Kalamazoo. Korfund Twin Rail Fan and Motor bases were used to prevent vibration and noise transmission into the supporting steel deck and the duct work.

. . . by installing over 200 fans and motors on Duplex bases

Upjohn has long been known for extreme care in the production of fine pharmaceuticals. Therefore, in building their new plant, quiet, spotless working conditions were a prime consideration. This called for 120 complete air conditioning systems with 324 Clarage Heavy Duty fans.

To conserve floor space, The Austin Company, Engineers and Builders planned the installation on suspended platforms and structural steel members under the roof.

Korfund Twin Rail Bases were specified so that no vibration or noise could reach the working areas through the steel decks or through the ducts, and to simplify the installation.

Complete adjustability of the Duplex Twin Rail separate bases for fan and motor made it easy to take care of variations in drive center distances, motor positions and other variables; and the exclusive built-in chocks in these bases guaranteed permanent alignment.

For installation of fans, pumps, compressors, refrigerating and other types of mechanical equipment for both normal and critical operating conditions, basic isolation recommendations are given in Korfund Bulletin G-104. See Sweet's Catalog Files, or write for your free copy today.

If you have a problem, we will be glad to submit recommendations without obligation. A half century of experience is at your disposal. Representatives in principal cities.

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Designed for Quick, Easy, Time-Saving Installation

Attractive appearance, outstanding performance and ease of installation have led to an increasing preference for Airtherm Convectors in institutions, apartments, homes and schools
Try AIRTHERM on your next job.
An Airtherm Heating Installation is your assurance of a satisfied customer.

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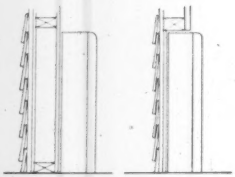
Write for Catalog 702A for additional information.



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AIRTHERM MANUFACTURING COMPANY

711 South Spring Avenue • St. Louis 10, Missouri

Hyde Park, Boston 36. The application section discusses heating and ventilating, industrial process work, air conditioning (process and comfort), air cleaning, and mechanical draft. Selection and application data is given.

Fan

HPAC 115—Folder describes "Fresh-Air Maker" fan, intended for use in steel or aluminum casement windows, but also applicable for sash windows or as a portable fan in offices, stores, etc. — Schwitzer-Cummins Co., 1125 Massachusetts Ave., Indianapolis 7. High speed rating is 2560 cfm.

Fan Timers

HPAC 116—Data sheet 352 describes and illustrates portable (plug-in type) and attic (installed type) fan timers — The Tork Clock Co., Inc., 1 Grove St., Mt. Vernon, N.Y. Specifications and prices are given.

Fans

HPAC 117—1952 catalog deals with pedestal, wall and ceiling fans; venturi-type and ranch type attic fans; electrically reversible window fans; industrial exhaust fans; spray booth fans; and shutters and blowers — Circulators and Devices Mfg. Corp., 128-168 32nd St., Brooklyn 32.

Filmstrips on Centrifugal Pumps

HPAC 118—Three booklets illustrate and give accompanying script of three new 35 mm sound filmstrips on centrifugal pumps — Allis-Chalmers Mfg. Co., Industrial Press Section, General Machinery Div., Milwaukee 1. The booklet, *How and Why of Centrifugal Pumps*, covers the filmstrip which explains parts and nomenclature, theory of operation, measurement of characteristics, and interpretation of curves. *Pump Maintenance* illustrates how to set up a centrifugal pump, starting procedure, lubrication, etc., and *Covering All Angles* gives information on pump selection and installation.

Filters

HPAC 119—Condensed catalog PL-200 describes standard models of "Fulflo" filters for microscopic clarification of industrial liquids and various gases — Commercial Filters Corp., 18 W. 3rd St., Boston 27. Covered are the filter tubes; single and multi-tube filters with capacities of 6 to 60,000 gph; and steel, brass, rubber lined steel and stainless steel models.

Flexible Ducting

HPAC 120—Bulletin 34 describes a number of applications of "Flexaust" light weight, flexible ducting, designed for air conditioning, dust collection, ventilation and fume control — American Ventilating Hose Co., 100 Park Ave., New York 17.

Ground Fittings

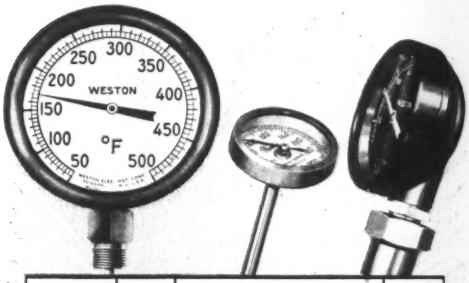
HPAC 121—Chart for selection of ground fittings shows how 30 common combinations of different ground wire and water pipe sizes can be made from 10 stock parts — The Thomas & Betts Co., Inc., Butler St., Elizabeth 1, N.J.

Humidity Conditioning Equipment

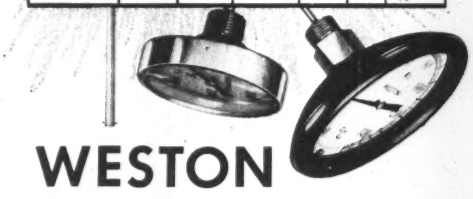
HPAC 122—Bulletin K-152 describes a number of installed applications of "Kathabar" humidity conditioning equipment — Surface Combustion Corp., Toledo 1. It is a collection of six business paper advertisements describ-

Available

in broadest selection of types, ranges, stem lengths



Type	Scale Length	Ranges		Stem Length		% Accuracy of Thermo. Range
		As low as	As high as	As short as	As long as	
Heavy Duty Straight Form	9"	−100F	+1000F	2½"	48"	1
Heavy Duty Angle Form	9 or 12"	−100F	+1000F	2½"	72"	1
Standard Angle Form	6"	−100F	+1000F	2½"	72"	1
General Purpose	4½"	−100F	+1000F	2½"	36"	1
Laboratory	3.40"	−100F	+500F	2"	24"	½ of 1



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all-metal THERMOMETERS

WESTON Thermometers give you *all* the advantages of all-metal construction *to an unmatched degree.* The durability of stainless steel stems . . . the readability of large, boldly marked scales . . . the sustained accuracy due to precision manufacture *proved* through the years. Order through your regular jobber, or your local WESTON Representative. Catalog T-13 on request . . . WESTON Electrical Instrument Corporation, 617 Frelinghuysen Ave., Newark 5, New Jersey . . . *manufacturers of Weston and TAGliabue Instruments.*

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Temperature Instruments INDICATE RECORD CONTROL

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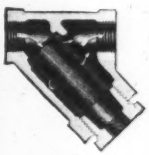
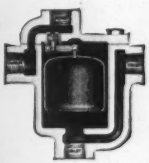
you can lose plenty if you are *UNDER-TRAPPED*

It doesn't pay to skimp on traps . . . especially steam traps. Water and air in steam lines reduces effective temperatures, wastes fuel and adds to maintenance costs.

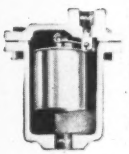
Clark Steam Traps have proven their outstanding drainage efficiency over many years of use in thousands of plants. Now, with the new Duo-Step double-drainage capacity feature, they can handle twice the condensate of ordinary traps. It will pay you to see your Clark representative or write us for further information.



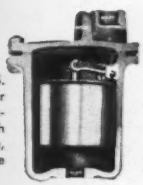
QUICK CLEANING STRAINERS. Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S.



SERIES "60" INVERTED BUCKET TRAP. Choice of horizontal or vertical inlet or outlet. For pressures up to 150 P.S.I. "Clark-loy" guided disc and seat.



CLARK "701"-D (DUO-STEP) TRAP. A forged steel trap for pressures up to 500 P.S.I. and temperatures of 750°F. Equipped with "double-drainage" Duo-Step leverage and venting, "Clark-loy" seats and discs. Pipe sizes ½" or ¾".



SERIES "80"-D (DUO-STEP) TRAPS. Cast semi-steel construction for pressures up to 250 P.S.I. and temperatures to 450°F. Equipped with Duo-Step Leverage and Venting, "Clark-loy" seats and discs. Pipe sizes from ½" to 2".

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THE HOME OF DUO STEP LEVERAGE

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Save space and cut installation costs

with

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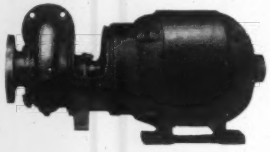

"Close-Cupld" Centrifugal Pumps

If you're looking for dependable, 24-hour-a-day pumping efficiency, yet are limited in space—you will find the Goulds Fig. 3650 "Close-Cupld" centrifugal pump ideal. This versatile, adaptable pump is a self-contained unit. It needs no space-consuming special foundations. There's no necessity for an unwieldly base plate to support pump and motor. This compact design also assures quick, easy installation—cutting costly labor time.

The Goulds Fig. 3650 is available in 17 sizes, with capacities up to 2000 G.P.M. Heads up to 400 ft. For complete information send for Bulletin 710.1.

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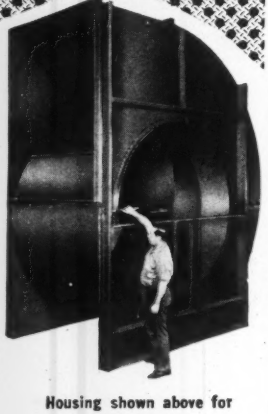
MASSACHUSETTS
Power Fixed and Squirrel Cage
FANS

POWER FIXED FANS

Backward curve blade type with non-overloading characteristics. Housings constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

SQUIRREL CAGE FANS

Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia.



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ing applications in the fields of laminated safety glass manufacture, moisture-sensitive products storage, comfort air conditioning, etc.

Industrial Chilling Machine

HPAC 123—Catalog sheet covers the new W-120-H industrial chilling machine for small heat treating departments, laboratories, etc. — Sub-Zero Products, 3928 Reading Rd., Cincinnati. It has a temperature range down to −120 F, and a thermal capacity of 500 Btu per hr.

Industrial Steam Traps

HPAC 124—Bulletin 152 features steam traps equipped with bellows of bronze, monel or stainless, and bodies in bronze, semisteel, and cast steel construction — W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa. Sizes are ¼ to 2 in. for all pressures from vacuum to 300 lb. Recommended piping diagrams, selection data, application information, etc., are given.

Manometers

HPAC 125—Print No. 828 (illustration) and data sheet U-51 describe the new Type B straight tube U-tube manometer, with scales ranging in lengths from 10 to 100 in., graduated in inches, 1/10 in. of water or ¼ in. of water or in inches of mercury, in tenths, or any other equivalent units such as pounds, ounces, etc. — Uehling Instrument Co., 473 Getty Ave., Paterson, N.J.

Overload Release for Speed Reducers

HPAC 126—Bulletin A-616 gives full information on the "Tri-Matic" overload release for torque-arm speed re-

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Take a look at the new silhouette . . . . it's low slung and streamlined — better looking on any roof!
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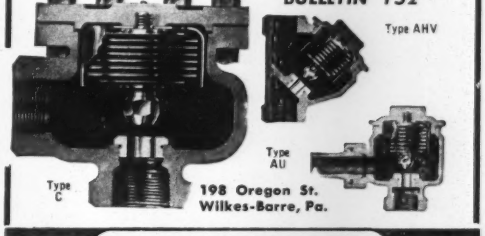

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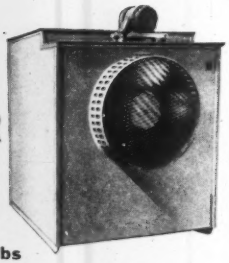

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ducers — Dodge Mfg. Corp., Mishawaka, Ind. Engineering data and list prices are included.

Pipeline Strainers

HPAC 127—Bulletin 252 describes a complete line of self-cleaning pipeline strainers in sizes of ¼ to 3 in. — V. D. Anderson Co., 1935 W. 96th St., Cleveland 2.

Pliers

HPAC 128—Catalog page covers improved pliers, for use in air conditioning, refrigeration, etc., in which jaws have been lengthened and other changes made — Lane Shur-Grip Tool Co., 1420 S. Michigan Ave., Chicago 5.

Pre-Stressed Concrete Slabs for Radiant Heating, etc.

HPAC 129—1952 catalog covers pre-stressed concrete floor and roof slabs, illustrating how they can be used in radiant panel heating (in warm air split systems and ceiling and floor type hot water applications) — The Flexicore Co., Inc., 1932 E. Monument Ave., Dayton 1. Diagrams show how slabs are used with all types of construction, and a simplified load chart is given.

Pumps for Air Conditioning

HPAC 130—Form 7177 is an illustrative bulletin on the various types of "Motorpumps" and their uses in the air conditioning field — Ingersoll-Rand Co., Resale Dept., 11 Broadway, New York 4. Applications shown include cooling towers, evaporative coolers and condenser water handling. Ratings and sectional views are given.

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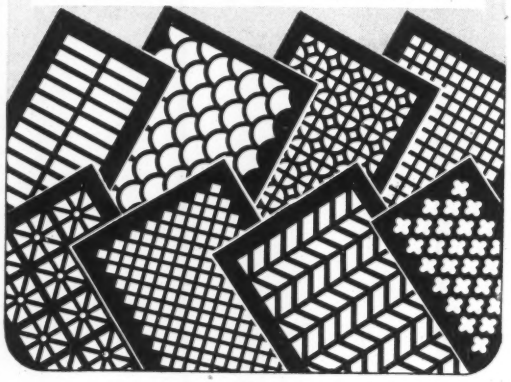

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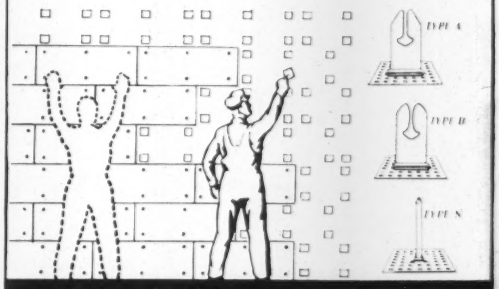

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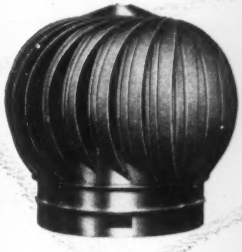

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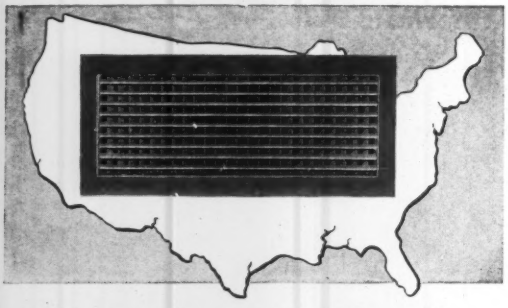

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100

Radiator Traps

HPAC 131—Bulletin 452 covers Type R radiator traps for vapor and vacuum steam heating service (pressures up to 25 lb) — W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa.

Reflective Insulation for Ceilings

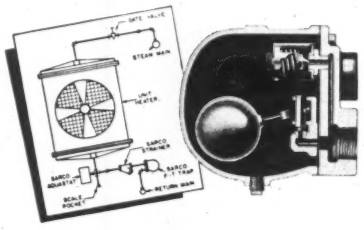
HPAC 132—Pamphlet illustrates and describes exposed ceiling applications of multiple-layer "Alfol" aluminum foil insulation — Reflectal Corp., Dept. PI, 155 E. 44th St., New York 17.

Safety Devices for Boilers and Heaters

HPAC 133—Bulletin SC-2, a 24 page catalog, is designed as a workbook to help in the selection and application of safety devices for steam and hot water boilers, and heaters — McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18. The booklet presents the various products according to function: water feeders for steam and hot water boilers, and for receiving tanks; low water fuel cutoffs for low and high pressure boilers; float operated switches; temperature and pressure relief valves; float valves; and related products. Capacity curves, dimension drawings, and engineering information are included.

Soldering

HPAC 134—Booklet, *How to Solder*, contains instructions and illustrations aimed at making soldering "more successful and easier to do" — Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5.



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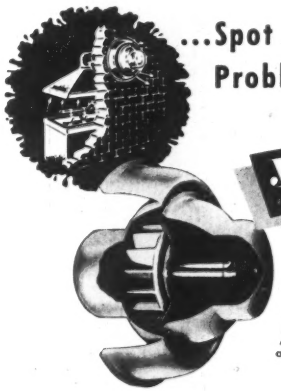

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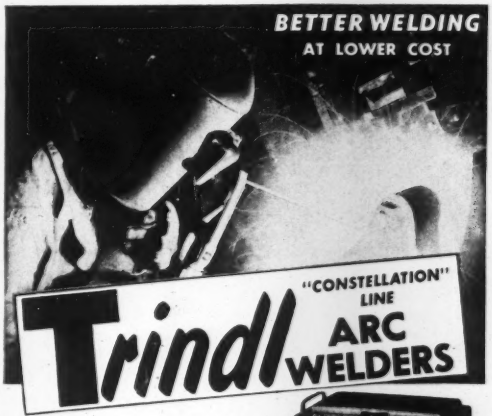

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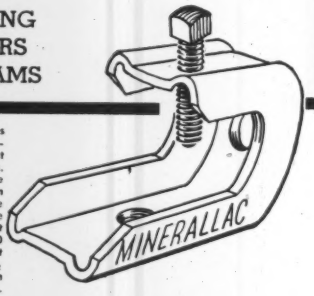

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Air Diffusers • Air Filters • Exhausters

Steam Generators

HPAC 135—Bulletin 1050 covers a line of steam generators, describing construction of the units and listing auxiliary equipment — Ames Iron Works, Box R-1, Oswego, N.Y. It also contains a blueprint, with dimensions, of a typical boiler room layout.

Steam Generators

HPAC 136—Bulletin 533 Revision "A" describes in detail a series of efficiency tests given the OK 1625 and OK 1740 steam generators — Vapor Heating Corp., Dept. PR, 80 E. Jackson Blvd., Chicago 4.

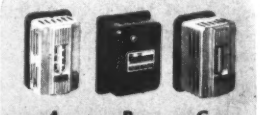
Water Conditioning

HPAC 137—New and revised data book, presenting a compilation of 77 tables, covers a variety of subjects relating to water conditioning—The Permutit Co., 330 W. 42nd St., New York 36. It treats such topics as hydraulics, impurities in water, chemical conversions, saturated steam, boiler feedwater make-up requirements, chemicals used in water treatment, alkalinity relationships, specific gravities and chemical reactions. The leatherette bound volume is available to practicing engineers and those who work with water conditioning problems.

Wheels for Weld Grinding

HPAC 138—Folder describes straight, cup, cone and reinforced hub wheels designed to cut weld grinding costs—Norton Co., Worcester 6, Mass. Applications are illustrated and there is a table of grinding wheel recommendations. The wheels are of "Alundum" or "Crystolon" abrasives.

A. TYPE B2
B. TYPE B4
C. TYPE B3A



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Systems around Buildings and Grounds

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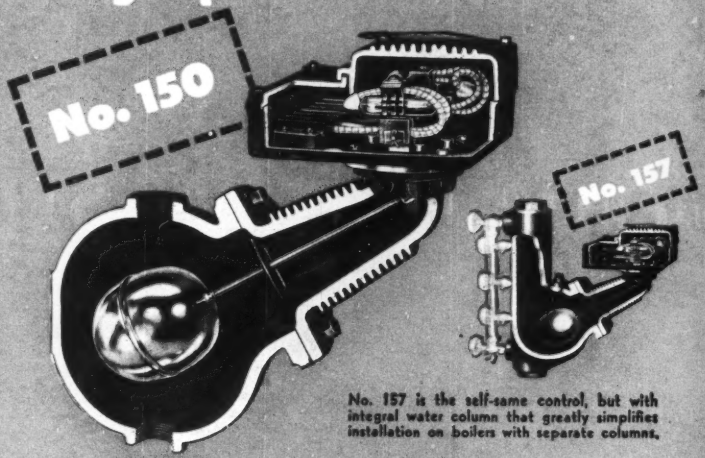
What "Doing One Thing Well" has done for high pressure boilers

Water level control for the high pressure boiler is the toughest challenge of all to "Doing One Thing Well." To work dependably in this service a water level control must be engineered down to the last detail to stand up in the presence of high pressure and the high temperature that goes with it. You have such a control in the McDonnell No. 150. It has been developed through study of operating requirements in countless applications—a dependable basic unit that can be wired as a low water fuel cut-off, as a low water alarm switch, as a boiler feed-pump control, or for any combination of these uses. Here are some of the features that set it distinctly apart:



No. 157 is the self-same control, but with integral water column that greatly simplifies installation on boilers with separate columns.

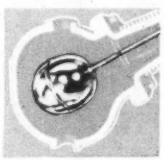
For boilers with pressures up to 150 pounds

1 Operating Parts Away From Heat

All operating parts are isolated from the steam and hot water zone. Radiating fins on housing help further to reduce temperature surrounding these parts.

2 Completely Packless

Genuine Sylphon bellows, made of heavy Monel metal, totally eliminate packing. Sylphons have integral base plate so they can be clamped in place in a mechanical seal that never lets go.

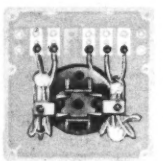


3 Heavy Welded Monel Float

Capable of withstanding pressures far beyond the rating of the No. 150, the float and rod are made of heavy monel metal, welded for maximum strength.

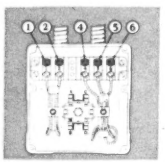
4 Porcelain Insulation on Lead Wires

Another typical refinement of the No. 150, this porcelain bead insulation is impervious to highest temperatures, yet provides ideal flexibility.



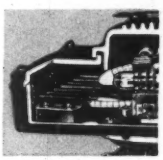
5 Dual "Multi-Purpose" Switches

Specially developed for high temperature service, the two heavy-duty mercury switches provide circuits for all purposes—for low water fuel cut-off, pump control, low water alarm switch, or any combination of these functions.



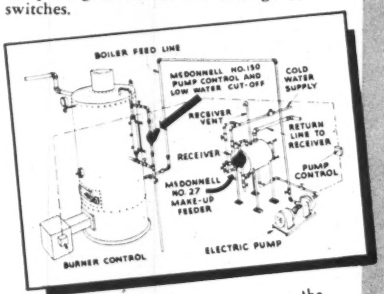
6 Easy To Wire

Easily identified and readily accessible terminals, in panel molded of high temperature phenolic, make wiring easy through two convenient conduit outlets.



7 Two-Piece Junction Box Cover

Provides access to terminal panel without exposing switches and leads. Main part of cover is factory sealed as a safeguard against tampering or accidental damage to switches.



McDonnell No. 150 controls pump the accepted best way—according to actual boiler requirements. Make-up feeder maintains adequate supply in receiver at all times. No. 150 can also be used for two or more boilers supplied by one feed pump; simple wiring diagrams are available.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

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McDONNELL *Boiler Water Level* CONTROLS